THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXIII. No. 1614.] LONDON, APRIL 17, 1894. [46TH YEAR. PRICE 6d.

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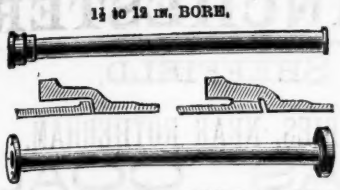
1¼ to 12 IN. BORE.



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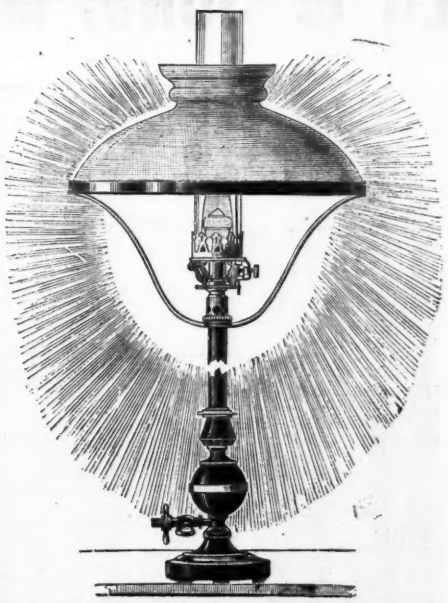

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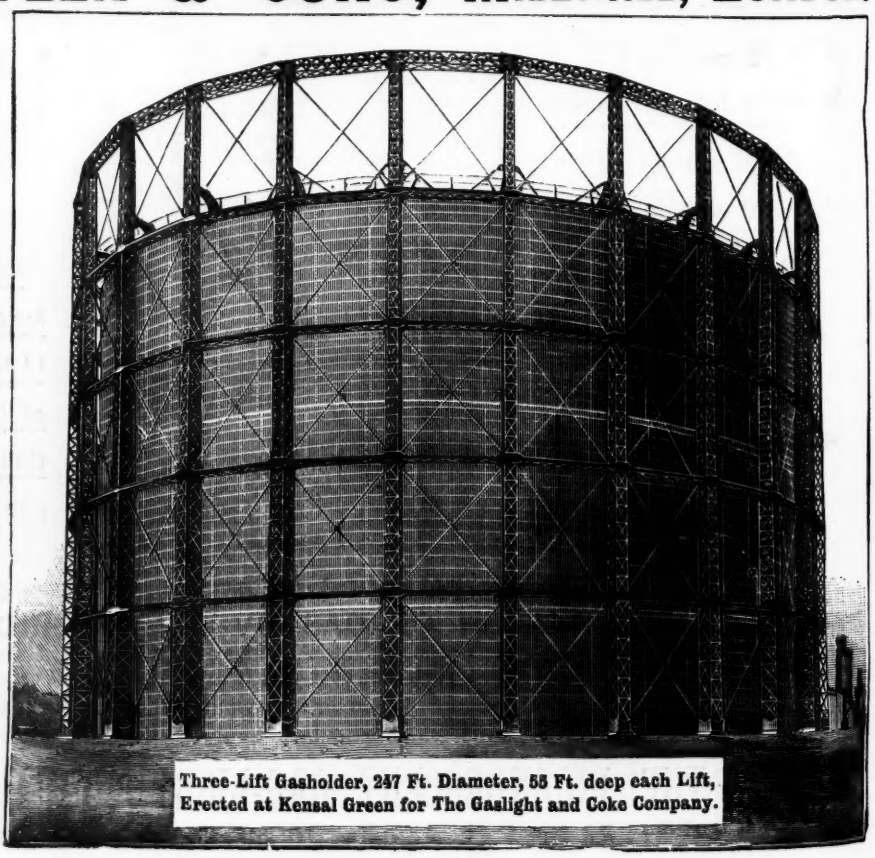

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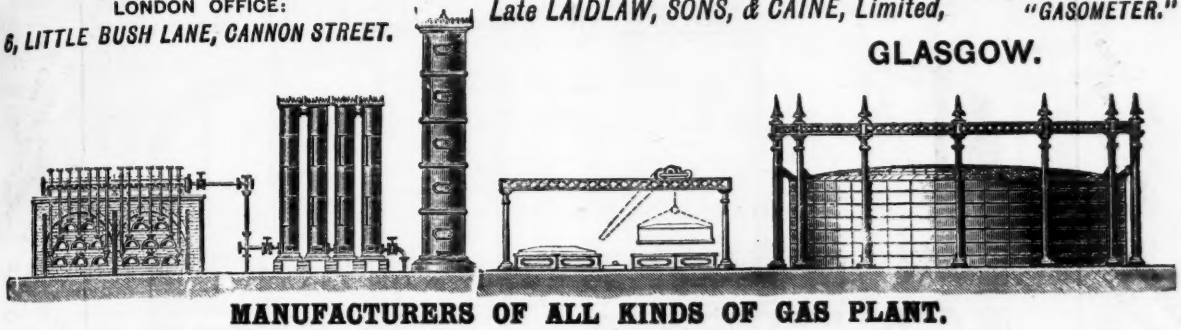

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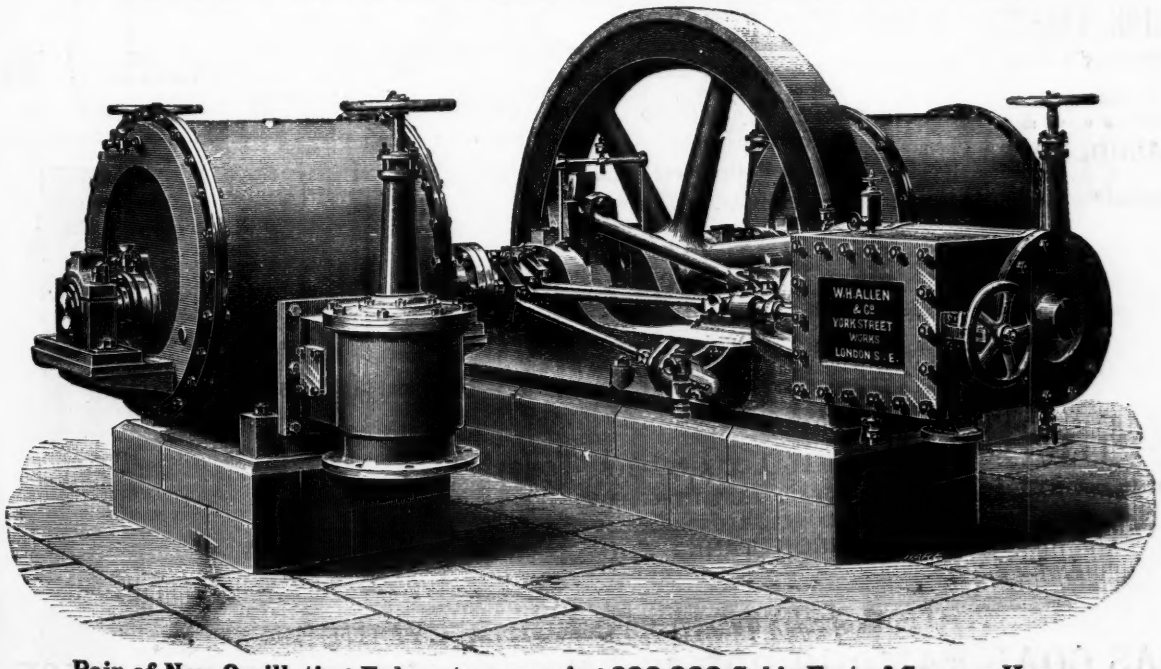

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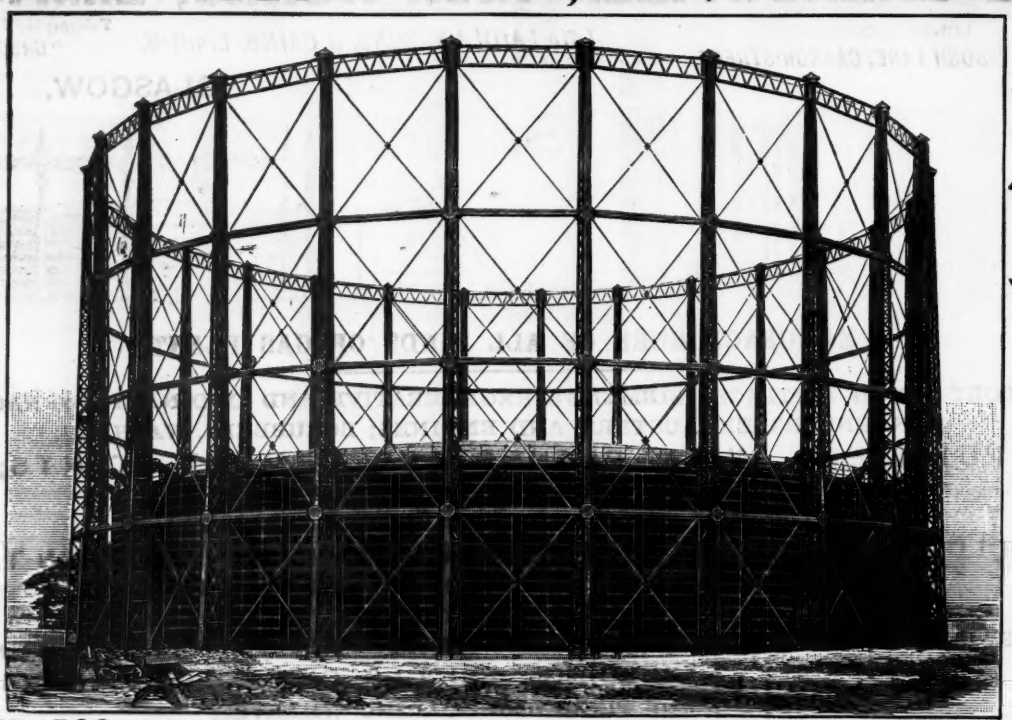

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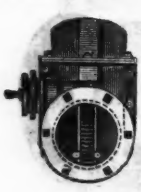

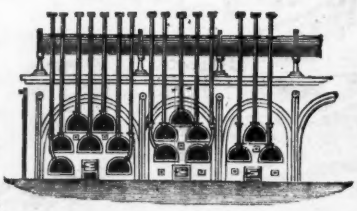

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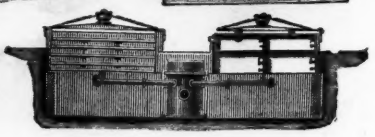

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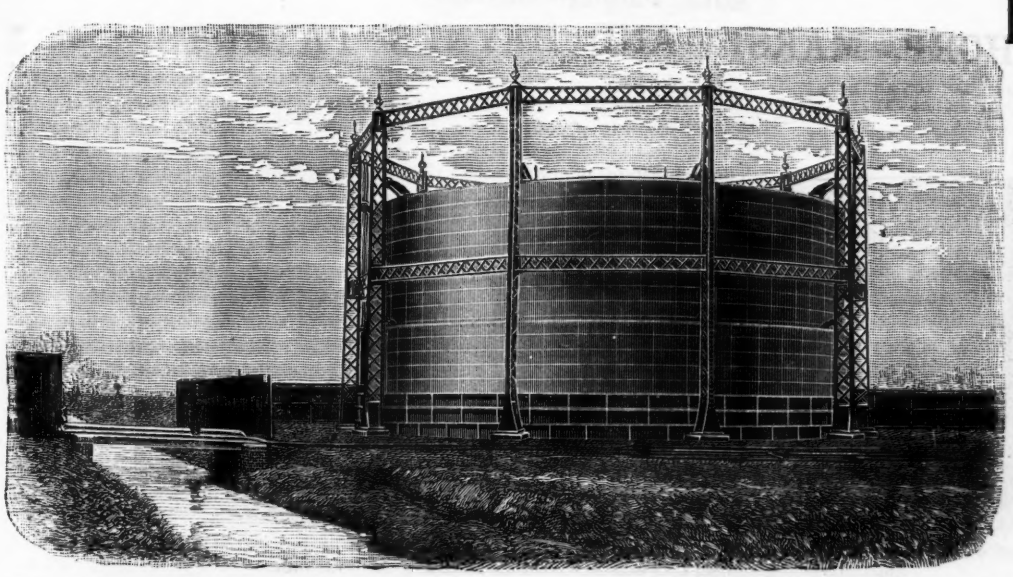

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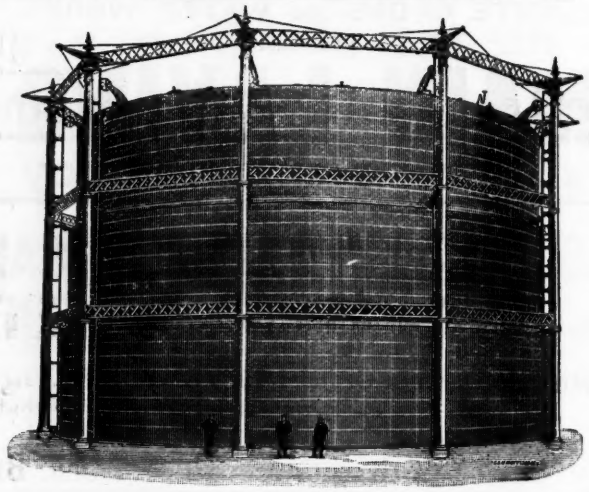

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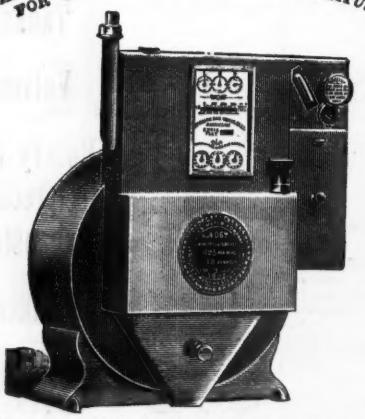

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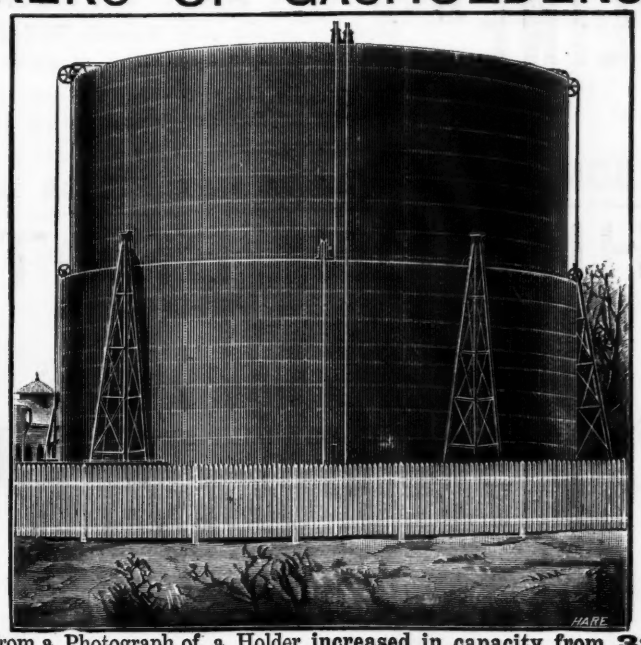

WIRE ROPE SYSTEM

This Engraving is taken from a Photograph of a Holder **increased in capacity from 32,000 cubic feet to 59,000 cubic feet** by the addition of a Lift. The Ropes are applied to both Lifts to supplement the Standards.

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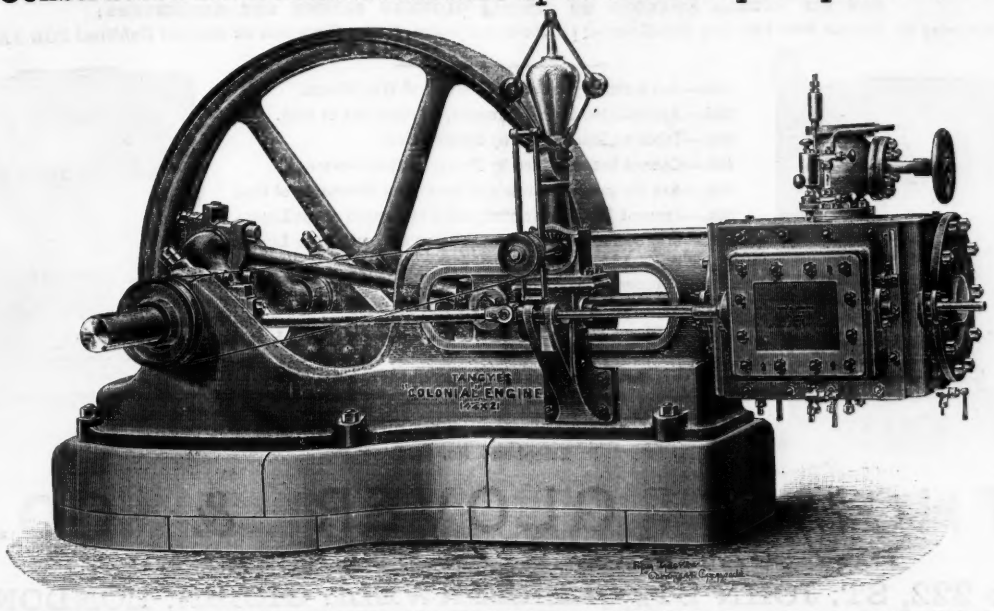

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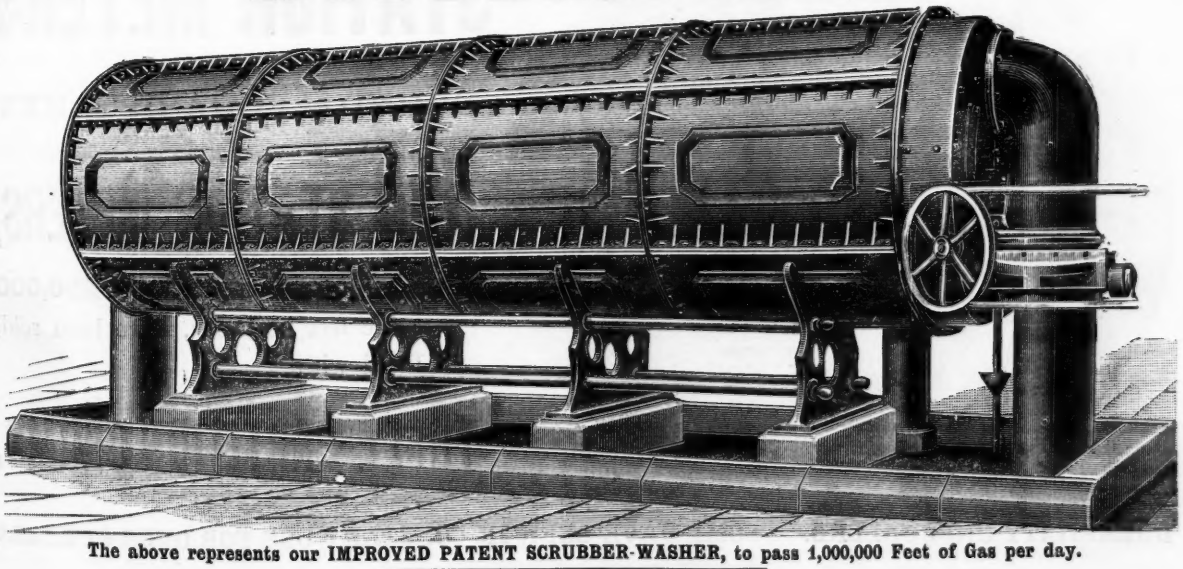

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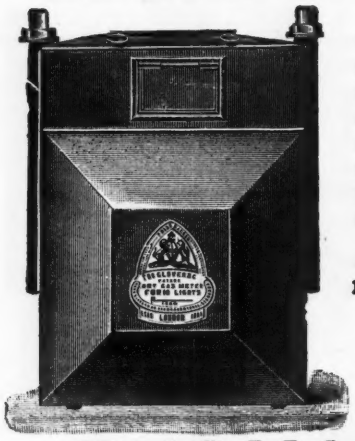

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7th.—May be fixed either above or below the level of the Lights.
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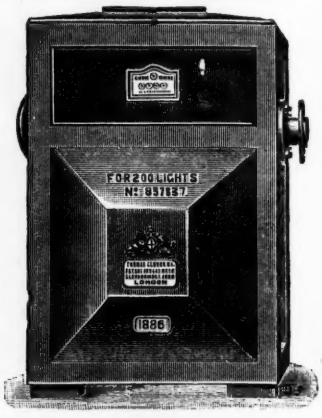
10th.—Will not cost more than one-half for repair that Wet or Water Meters do.
Are upheld for five years without charge.



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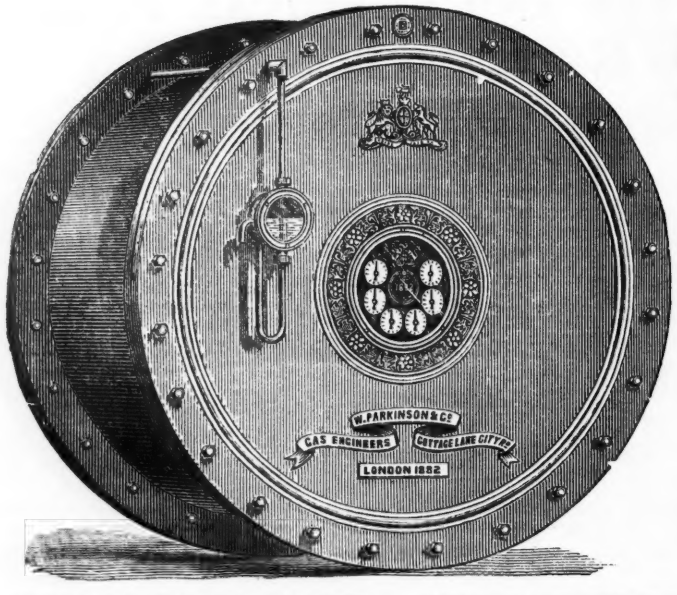

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TO CORRESPONDENTS.

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THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, APRIL 17, 1894.

London Gas Companies' Accounts for 1893.

On another page will be found our customary analysis of the accounts of the Metropolitan Gas Companies for the past year, from which, as usual, much information in a condensed form may be obtained with regard to the financial and statistical conditions under which London is supplied with gas. The statement possesses exceptional interest at the present juncture, moreover, in consequence of the recognized existence, during the period embraced by it, of extraordinary circumstances likely to affect the business of the Companies in various ways. To begin with, the sum of the capital employed by all the Companies is shown to amount to £16,325,667; being an increase for the year of £183,700. In the year 1892 the increase was more than double this amount, having been £405,713; the difference being obviously referable to the fact that whereas in that period all the undertakings were engaged in making large extensions of plant, to cope with a possible repetition of the severe strain that several of the hardest winters of the latter half of the present century had brought upon them, the more recent conditions were of a totally different character, so that the undertakings merely had to provide such new and improved appliances and buildings as were found to be necessary in order to round off their equipment according to modern engineering ideas. Moreover, such progress as was made along this line had to be carried on under the regimen imposed by a diminished revenue. Here we find one of the salient differences between the business of gas supply and that of other industries and services with which it is sometimes classified. Railway companies, for instance, look for an expanding revenue; whereas gas companies working under the provision of the sliding scale have to accept an automatic adjustment of prices to profits which is only compensated for by the influence of the same controlling agency upon the cost of capital. Thus it will be found that while last year the people of London paid £3,624,440 for gas sold by meter, and £224,049 for public lighting by gas, the former sum was £170,728 less than they paid during the previous year, and the latter only £208 more. Meter and stove rentals show the satisfactory increase of £4022 for the year; and residuals brought in £68,469, albeit the quantity disposed of was smaller. The gross revenue of all the Companies amounted to £5,102,848, which was £97,692 under the return for 1892.

On the expenditure side of the account large differences are shown between the figures for the two years. Whereas last year coals cost £1,729,870, in 1892 the cost was £295,224 more. Purifying cost £87,961, which was a drop of £18,775; and the labour charges for manufacture fell from £510,837 to £498,636—thus showing a decrease of £12,201. This, however, is not strictly speaking an economy; for, as we shall haveoccasion to mention presently, the proportionate cost under this head was heavier. Wear and tear went up £28,099; the works managers being able to appropriate more money to these purposes. Management salaries show the not inconsiderable saving of £1556. Rents, rates, and taxes swelled by £26,494 to the handsome sum of £236,293, of the chief reason for which nothing more need be said here. Law and parliamentary charges were £9126 heavier; and bad debts and extraordinary expenses showed the serious increase of £11,087. This entry, mostly representing dead loss, was a burden upon the undertakings of no less than £71,671. Altogether, the gross expenditure of the Companies upon revenue account shrank from £3,783,123 to £3,548,625, or a decrease of £234,499; and the profit balance rose from £1,417,415 to £1,554,222—its proportion to the gas-rental expanding from £35 5s. 5d. to £40 7s. 9d. per cent., and representing £9 10s. 5d. per cent. on the capital.

In contemplating totals and proportional data of this kind, it is practically impossible to make and preserve the important distinction between increases and decreases due to what may be called natural causes, and wastes and economies properly so called. For example, when we learn that the cost of the coal required to make gas for London fell last year to an average of 12s. 3·56d. per ton, while for the previous year it was 13s. 11·11d. per ton, one would naturally like to know how much of this difference was due to the turn of the market, how much to improved business acuity on the part of the officers who do the bargaining for the purchasers, and how much to the introduction of labour-saving appliances for transporting and handling the raw material of which so much has lately been heard, and which are responsible for a goodly proportion of the newer capital outlay. These are points which no mere analysis of the formal accounts published by the Companies can elucidate; but we lay stress upon them here by way of illustrating one of the directions in which papers on gas-works administration and management are competent to supplement data derived from gas companies' accounts. The consideration in question is of importance as tending to bring out the truth, not always adequately realized, that such statistics as those now under notice are of value only to those who understand their limitations. We sometimes see similar data treated

as if it were superfluous to go behind them, and inquire into their origin; but this is exactly what an engineer or an administrator must do if he is to exercise any real power over the creation of the figures representing his own performances. That figures, when collected into statistics, are fossils, is a truth many statisticians fail to grasp.

To return, however, to our statement. As already remarked, there has been a drop, which may or may not include a saving, in coal. Purifying has also been effected more cheaply all round. The most disappointing figures in the whole set are those relating to the labour costs of manufacture. It cost on the average 3s. 6·53d. per ton to make coal into gas in the London works last year, whereas in 1892 the cost was 3s. 6·15d. The difference is small, it is true; but it is on the wrong side, and consorts ill with all that has been heard in regard to the adoption of labour-saving appliances in the largest works. Let us examine into this matter more particularly. Salaries and wages in gas manufacture cost the Chartered Company 3s. 7·91d. per ton; they stood the Commercial Company in 3s. 10·14d. per ton; and the South Metropolitan Company—who spent, be it remembered, £14,394 under their profit-sharing scheme, to which neither of the other undertakings of the group has any parallel—got off for 3s. 1·76d. per ton. It may be asked why, in the name of all that is reasonable, the South Metropolitan Company should be able to get their carbonizing work done so much cheaper than the other Companies, if this result is not the simple product of a better system, and better management? Wherein have the South Metropolitan Company any other advantage? These are questions which it would be idle to ignore, and from which it is impossible to escape. If Mr. George Livesey chooses to use these figures as proof of the superiority of the system of working adopted by his Company, what can be urged to the contrary? The fact remains, for whomsoever pleases to make the best or the worst of it, that the Chartered Company pay more than 6d., and the Commercial Company something like 8½d. more for carbonizing every ton of coal they respectively convert into gas, than similar service costs the South Metropolitan Company—the same rates of wages prevailing all over London. Anybody who pleases is at liberty to calculate, upon the bases supplied by these data, how much London north of the Thames loses from the existence of these different degrees of efficiency in the working of the various gas manufacturing stations. Again, the administration of the Chartered Company can hardly congratulate themselves upon having to pay 10d. per ton more by way of rates than their neighbours.

Lastly, we have to present in the following table the carbonizing results of the different Companies, as revealed by their accounts:—

TABLE *of the Residuals and Gas made, per Ton of Coal carbonized, by the Metropolitan Companies in the Year* 1893.

Name of Company.	Coke per Ton of Coal, in Bushels.	Breeze per Ton of Coal, in Bushels.	Tar per Ton of Coal, in Gallons.	Ammoniacal Liquor per Ton of Coal, in Gallons.	Gas Made. Cub. Ft. per Ton.
CHARTERED . . .	44·78*	3·11*	9·88	28·97	10,287
COMMERCIAL . . .	45·03*	5·07*	9·91	36·12	9,997
SOUTH METROPOLITAN	49·08	3·65	9·64	33·84	9,982
Mean per Ton . .	45·88	3·40	9·83	30·73	10,189

* The returns of coke and breeze are given in *tons* in the Chartered and Commercial Companies' accounts. They have been reduced to bushels on the basis of 9½ cwt. of coke to the chaldron, and 50 bushels of breeze to the ton.

Remarks.—In working out the results shown in the above table, as well as those in the second table on p. 697, the equivalent in cannel of the oil used as an enricher was added to the figures giving the bulk of solid raw material carbonized. Where this equivalent was not furnished in the accounts, it was estimated on the basis at present adopted.

The preceding table speaks for itself, and does not need any comment or explanation except such as may be implied in the observation which it would suggest at sight to every experienced gas manager—that the highest efficiency of coal carbonization does not appear to have any connection with working expenses.

Technical Society Meetings in the Past Week.

GAS technology was well attended to last week. Taking the events in order of date, there was first the adjourned discussion at the Institution of Civil Engineers upon Mr. Charles Hunt's paper, the smothered character of which bore out the stricture we passed last week upon the conduct of these Institution meetings. A more hole-and-corner performance than the sort of discussion favoured by the authorities of the Institution it would be difficult to find now-a-days. The following evening, Professor Vivian B. Lewes read before the Society of Arts his paper on "London Coal Gas and its Enrichment," the text of which appears elsewhere. This composition was admittedly addressed to consumers rather than to engineers. But it is a first-class example of its kind; and, in view of the lamentable ignorance of gas matters under which the bulk of the public labour, it is the sort of paper of which it is hardly possible to have too many. We shall not attempt to criticize Professor Lewes's observations, but content ourselves with the statement that the paper is a powerful argument for the distribution of unenriched gas. The discussion, some notes on which we are compelled to hold over, was very fruitful, thanks, in a great measure, to the free participation therein of intelligent men of both the technical and non-technical orders. One point that was brought out very prominently in this way was the hindrance that is put by rich gas in the path of burner improvement. The last—or rather the latest—event to be chronicled here is the so-called annual "informal" meeting of Scottish gas managers, which was held in Glasgow on Wednesday, under the presidency of Mr. T. Wilson, of Coatbridge. It was well attended; and the proceedings were as interesting and enjoyable as usual. The company paid a visit by invitation to the Dawsholm station of the Glasgow Corporation Gas Department, where they were received by Mr. W. Foulis, and shown the Lowe pattern water-gas plant, erected by Messrs. Humphreys and Glasgow, and the Arrol-Foulis retort-working machinery. Mr. Yuill, of Alloa, talked about his experience with the Peebles oil-gas process; Mr. D. M. Nelson got in a few words about the Yeadon retort; and, in short, the essence of informality which the promoters of these gatherings parade as their peculiar distinction did not prevent the meeting from being as purely "shoppy" as the most strait-laced assembly of a District or Provincial "Institution," with all the cumbrous machinery of officers, rules of procedure, select membership, and the other paraphernalia of regular technical and scientific bodies. To Mr. M'Gilchrist, of Dumbarton, is due the credit for organizing these most useful annual assemblies.

The Price of London Gas in Parliament.

MR. J. ROWLANDS, M.P., has found for himself a "mission" in life, which is no other than the self-imposed task of bringing into prominence, with a view to rectification, the different prices charged for gas by the Metropolitan Gas Companies. We have scrupulously refrained from commenting upon the "agitation" that is being fanned, with more industry than success, by Mr. Rowlands and his fellow-workers upon this line, for the reason, among others, that nothing much has yet come of it. It will be time enough to deal with the subject upon its merits when Mr. Rowlands has developed a tangible scheme for treating a matter that is at any rate a result of legislation, whatever else may be said about it. At present, the most he has effected has been to excite several London Vestries on the subject, and to raise the question of the cost of the gas supply to the Houses of Parliament. Unhappily for him, the Vestries have no immediate interest in the discrepant charges for gas to the private consumer, inasmuch as over by far the greater part of London the price of the gas consumed in the public lamps is equal, and is determined by the lowest rate at which the South Metropolitan Company are willing to perform the service. As for his hope of getting the House of Commons to take an intelligent interest in the subject of the price of gas in London, Mr. Rowlands must by this time be sorry that the limitations of "questions" have so far prevented him from making the point he is aiming at. He put on the paper a formal question, to ask the First Commissioner of Works—who happens to be Mr. Herbert Gladstone—how much gas was consumed in the Houses of Parliament during last year, what it cost, and the price per 1000 cubic feet charged by the Company. In reply, he was told that the total gas consumption in the Houses of Parliament and their precincts for the year 1893 was 27,871,000 cubic feet, costing £4223, besides £33 for meter-rent; and that the price was 3s. 1d. per 1000 cubic feet except for the street lamps, for which the charge was 2s. 2d. per 1000 cubic feet. So far the question and the answer were alike irreproachable; and we only desire to draw attention in this regard to the fact that, for a range of buildings

popularly supposed to be lighted by electricity, the precincts of St. Stephen's bring in a pretty fair revenue to the Gas Company. After the facts, however, came the fiction. Mr. Rowlands said he understood that the Vestries of London are just now paying for the gas used by them "for all purposes" at the uniform price of 2s. 2d. per 1000 cubic feet; and he wanted to know why the Houses of Parliament could not also be served at the lower scale. To this inquiry the First Commissioner of Works could only reply vaguely, that he believed there were two qualities of gas supplied by the Company—a statement which, according to some reports, elicited a laugh. It is to be regretted that the two honourable members who got up this little bit of quiet amusement in the House were neither of them posted as to the facts. It is certainly not true that all the London Vestries get their gas for all purposes at the lower price; but only that this is the price charged by the two largest Metropolitan Companies for gas consumed in the public lamps, whoever pays for it. Neither is it true that The Gaslight and Coke Company now supply two qualities of gas, although this was the case until a comparatively recent period. The unfortunate aspect of Mr. H. Gladstone's slip, moreover, is that, as he put the matter, it seemed to convey the impression that the gas supplied to London street lamps is of a different quality from that consumed in the Houses of Parliament. Hence the cheap laughter that greeted his mistaken observation. Human nature being what it is, even Members of Parliament are apt to put the worst interpretation upon a statement susceptible of two meanings; and it is therefore to be regretted that Mr. H. Gladstone's unintentional misrepresentation of the facts should have had the appearance of casting a slur upon the Gas Company. Perhaps, however, blame should rather be imputed to the reporters of those newspapers who failed to grasp the First Commissioner's meaning.

Undertaking, or Old Iron?

SOMETHING very like consternation must have overcome many people besides shareholders in tramway companies last Friday morning, when they were made aware by the newspapers that Sir Frederick Bramwell's valuation of the property of the London Street Tramways Company, (to be acquired, under the terms of the Act, by the London County Council), which had been upset by the Divisional Court, was restored by the judgment of the Court of Appeal. We discussed this award at the time it was made; and it is therefore unnecessary to say more than that it disregarded the usual meaning of the term "undertaking" as applied to tramways in the Act of 1870, and fixed a bare structural value upon the plant as representing all that the County Council were to pay for. This view was overruled by Justices Mathew and Collins so recently as Jan. 22 last; and the award was returned to the Arbitrator in order that he might amend it by inserting due consideration for the rental value of the undertaking. The uncertainty of the law has once more been exemplified by the disagreement of a strong group of three Lords Justices of Appeal, without a dissentient voice, with their learned brothers of the Divisional Court. Lord Justice Lindley, in giving judgment for the County Council, held that, as the rights of the Tramway Company were terminated, according to the statute, by the act of purchase, the County Council could not be asked to pay for the transfer of a rent-earning capacity to which they succeeded by statutory process. The Company will, of course, carry the matter to the House of Lords, as the point is of vital importance to them. If the Appeal Court is right, it is a bad business for the shareholders, who were certainly not prepared to part with their property at an old-iron price. But it seems a pity that, if such is the law, this could not have been ascertained years ago, when some provision might have been made, by way of sinking fund, against the day of confiscation.

Imperial Continental Gas Association.—The Directors of this Association recommend a dividend of 5 per cent. for the half year ending Dec. 31 last, and a bonus of 1 per cent., both free of income-tax.

The Managership of the Stoke Gas-Works.—We understand that Mr. W. Prince, formerly of Darlington, and recently foreman at the Stoke Gas-Works, has, by a unanimous resolution of the Gas Committee, been appointed Manager. Of course, the action of the Committee will have to be confirmed by the Council.

WATER AND SANITARY AFFAIRS.

LONDON is being trifled with, by the Government and by the County Council. The Southwark and Vauxhall Water Bill was only allowed to pass its second reading on Wednesday last, on the understanding that the 13th clause, giving power to the Company to take additional water from the Thames, was withdrawn. The drama of Hamlet is to be played, with Hamlet left out. Of what use is the Bill, if the supply taken from the Thames is to be as before? The Government have resolved on this dictum. That is to say, no additional abstraction of water is to be authorized. On this question the Government take their instructions from Spring Gardens. They care nothing for the report of the Royal Commission. That report declares it to be a perfectly safe thing, with proper storeage, to draw 300 million gallons of water per day from the Thames. The County Council and the Government decide that there shall be no increase of the present allowance, although it only goes so far as 130 million gallons. Yet all the while it is thoroughly understood that the Southwark and Vauxhall Company are taking five or six million gallons of water per day more than their utmost legal *quantum*. It is equally certain, and equally well understood, that they will take still more during the coming summer. There is also a clause in the Thames Conservancy Bill which renders the Company liable to a penalty of £100 for every day in which they draw more than 24½ million gallons. The Thames Conservators, represented by Mr. Dixon Hartland, would have moved the rejection of the Southwark and Vauxhall Bill, had the 13th clause been retained. Yet the Conservators knew perfectly well that the Company were largely exceeding their prescribed limits, and would continue to do so. Are the Company to be fined if the Conservancy Bill passes? Of course not. Will the County Council object if the Company draw a maximum of 35 million gallons in the coming summer? It is not likely. The Company may go on and draw what they want for the use of their consumers—at least for the present. If they can make a compact with the Chelsea Company, to take the water which that Company may have to spare, so much the better. But if there is no compact, nothing need be said. We may ask, if there is a compact, what difference will it make to the river? There is one thing which would have made a difference; but this has been recklessly flung aside. Had the 13th clause been preserved, so also would the Thames have been secured a minimum flow of 200 million gallons a day. This guarantee is now lost; and the river is left to all the risks of a growing demand and an uncertain rainfall.

In the proceedings relative to the Southwark and Vauxhall Bill last Wednesday, the hand of the Government did not appear. But it was there, none the less. It was well known that, if no pledge was given by the promoters of the Bill to withdraw the 13th clause, the Government would render suit and service to the County Council, and muster every vote to defeat the motion for the second reading. The Government knew their strength; and, in defiance of the decision and the debate relative to the Bill of the East London Company, they were prepared to fight. Perhaps it was a pity they were not given the chance. But the Southwark and Vauxhall Directors acted as men who consider that there are occasions when discretion becomes the better part of valour. Rather than run the risk of sacrificing the entire Bill, they gave up a vital part. It may be asked: Of what good is the Bill, supposing it passes in its present form? The good seems to be this—that the Company may fill their reservoirs by getting help from their friends at Chelsea. Or they may dig wells; and, in the meantime, they can trust to their luck. But what are the County Council going to do? Mr, Shaw Lefevre fully expects that they will set to work and prepare "a definite scheme." To be consistent, they must take nothing from the Thames or from the Lea; and yet, by a delicious piece of irony, Mr. Benn wishes to see a clause introduced into the Bills of the Southwark and Vauxhall, West Middlesex, and East London Companies, enabling the Council to acquire the undertakings of the promoters, "if the same "can be obtained on fair and reasonable terms." We wonder when we shall see anything "reasonable" in the treatment awarded to the Water Companies. They must supply water, but they may not take what is necessary for that supply. They may appropriate what

they want, and break the law in doing so; but the law must not be amended, so as to render that legal which is known to be necessary. The County Council complain that the present water supply is not good enough; but they are willing to buy it, if they can only get it—paying such a price as, in their opinion, happens to be "reasonable." Ten or fifteen years hence there is to be a supply from an entirely new source; yet who can tell what will be on the morrow, or what will be the issue of the next General Election? The water supply of London is made the sport of political parties; and unless London takes care of itself, it may have cause to lament that its eyes have been in the ends of the earth, when it ought to have been looking closer at home.

The London Water Companies' Bills before Parliament.—A notice of motion by Lieut.-Col. Ford, to come before the County Council to-day, seeks to secure a provision in the Water Companies' Bills now before Parliament, to the effect that any money to be raised for the purposes of the Bills shall be borrowed of the County Council, or raised in such other manner that the dividends of the shareholders shall not thereby be increased; also that, in the event of purchase by the Council of the Companies' undertakings, the purchase money in respect of the additional works shall not exceed the amount expended upon them.

Association of Municipal and County Engineers.—A Home Counties District Meeting of this Association was held at Reading on the 7th inst., under the presidency of Mr. J. T. Eayrs, of West Bromwich. The members were received in the Town Hall by the Mayor (Mr. C. G. Field). One of the papers read was by Mr. A. T. Walker, Assoc.M.Inst.C.E., Manager of the Reading Water-Works, on the "Recent Extension of the Reading Water-Works, and the Use of Polarite therein." The author spoke highly of the success which had attended the employment of this material as a filtering medium. Mr. A. E. Collins, Assoc.M.Inst.C.E., the Borough Engineer, read a paper on "Some Municipal Works in Reading." He stated that the most important work carried out in the borough had been the purchase and preparation of the sewage farm and the construction of the sewerage system and the pumping-station. The works cost about £350,000. After the meeting, the members paid various visits, and inspected the gas and water works.

Use of Coal Gas in the Manufacture of Writing Inks.—It is not generally known that the quality of ordinary writing ink depends on the gas supply. The best black inks are made from galls; and the use of vegetable (oak) galls has been superseded for many years, by dried animal galls, which come almost exclusively from China. These are roasted in revolving cylinders, in charges of about 2 cwt. each, at a temperature of 300° Fahr.; and as the exact temperature is of the utmost importance, gas is exclusively used for the purpose. The burners have an average consumption of 200 cubic feet per hour; and in an ordinary ink manufactory the work is considerable. As with mustard, the demand is created rather by what is dried up and wasted than by what is used. Mr. T. Fletcher, of Warrington, who has forwarded the preceding particulars, points out that this is one of the apparently small industries, which are in reality large; and help to swell the receipts of the gas companies from gas for other and more regular purposes than lighting.

Death of Mr. W. Haywood.—In the JOURNAL for the 27th ult., we recorded the resolution passed by the Commissioners of Sewers on the previous Tuesday to relieve their Engineer (Mr. W. Haywood, M.Inst.C.E.) of active duties in connection with his office, on account of ill-health, but to retain his services as Consulting Engineer. Mr. Haywood did not long enjoy the rest which it was hoped would be so beneficial to him; for he died last Friday morning, at his residence at Maida Hill, in his 73rd year. Deceased became Engineer to the Commission in 1846, having been previously Assistant-Engineer; and during his 48 years' tenure of office he carried out some very extensive works. In 1851, in conjunction with Mr. Frank Forster, he prepared a scheme for diverting the sewage from the northern side of the Thames. Three years later, he and Sir Joseph Bazalgette extended the scheme; and it was eventually carried out by the Metropolitan Board of Works. Between the years 1863 and 1870, he completed the Holborn Viaduct; and in 1879 he furnished the City with a complete system of fire hydrants. The site of the new Tower Bridge, which was visited two years ago, during its construction, by the members of the Institution of Gas Engineers, was, we believe, originally suggested by Mr. Haywood. It is stated that during his period of service he carried out improvements in something like half the streets of the City—among which may be mentioned the construction of Queen Victoria Street and the widening of Ludgate Hill; and he was the first to lay down asphalte pavements in the carriage-ways. Deceased was formerly Colonel Commandant of the London Rifle Brigade; and he was one of Her Majesty's Lieutenants for the City. He joined the Institution of Civil Engineers as an associate in 1848, and became a member in 1853. He was a Fellow of the Royal Institute of British Architects, and the holder of several foreign orders.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 722.)

THE rapid advance in point of activity which the Stock Markets have recently been achieving, sustained a check—only momentary, in all likelihood—last week; and business became decidedly quieter. For some reason or other, buying orders fell away considerably; and there was less speculation in the air. It was account week, and the settlement was a good deal heavier than it has been of late; and perhaps there was a disposition to see it through before entering upon fresh commitments on any very extensive scale. Prices in general, however, have not suffered in the long run, although several markets fluctuated from day to day. All the chief departments show little change; but, among the miscellaneous, "beer" has been agitated by apprehension of taxation, and tramways have been depressed by the decision of the Court of Appeal. The latter incident is the event of the week, and has set investors cogitating whether they will once more be able to say: "Thank God, we have a House of Lords." Money has been in good demand; and the Market remains steady. Gas, upon the whole, was a little less active than in the preceding week. The general tendency continues very good, although the two chief issues in the market show a little falling off. Gaslight "A" stock, which, for reasons already mentioned, has been easier lately, lost a couple of points more, but showed at the close a fair disposition not to give way any more. Business in the secured issues was not extensive, and exhibited no sign of any movement either way. South Metropolitan "B," which had been gradually brought up to an extremely high figure, was offered at a slight reduction. It still, however, stands considerably in advance of "A" and "C." Nothing was done in Commercials, exept the debenture, which commanded a high price; but both the old and the new stocks were quoted higher *ex div.* Hardly a bargain was done in Suburbans or Provincials, except in British; but Bristol rose a point. In Continentals, the satisfaction felt at Imperial paying the usual bonus set that stock up 5; and Union also made further advances. None of the remoter undertakings moved, except San Paulo, which approached par. The Water Companies were very quiet, and almost unchanged. East London rose; and it looks strong enough to go higher.

The daily operations were: Gas opened unchanged; but the chief issues did not command the best prices. Commercial debenture rose 2. Business on Tuesday was much about the same. Quotations were downward, with a fall of 2 each in Gaslight "A" and South Metropolitan "B." Wednesday was extremely quiet; but the tendency was favourable. Commercial debenture gained 2 more; and South Metropolitan "C" and Imperial Continental changed hands at top prices. Thursday was more active and buoyant. Imperial rose 5; Continental Union, 2; ditto preference, 1¼; and Bristol, 1. Several *ex div.* quotations also showed a rise. Friday's business offered no remarkable feature; and the only change was an advance of ¼ in San Paulo. Saturday also was about as usual; and quotations closed unchanged.

ELECTRIC LIGHTING MEMORANDA.

Herr von Oechelhaeuser upon Electric Lighting Stations—Mr. Hiram S. Maxim's Part in the Development of the Incandescent Electric Lamp—An Epoch-Making Discovery.

REFERRING to some comments we recently offered upon the portion of the last report of the administration of the German Continental Gas Company which relates to the electric lighting station belonging to the Company at Dessau, Herr von Oechelhaeuser, the General Manager of the Company, informs us that the actual condition of this undertaking may be taken as an indication that the district has already been supplied to the saturation point with electric light. He states that the Superintendent of this small central station is unable to get additional customers, and even to retain all the original incandescent lamp connections, now that the new Welsbach light has been introduced into the town. It must be taken into consideration, as bearing upon this competition of the two lights, that the Superintendent of the Dessau electric lighting station is quite independent of the Manager of the local gas-works, although the two concerns belong to one proprietary. Each establishment carries on its own business, and the respective Managers sharply compete in the endeavour to justify themselves in the estimation of the common employer. The comparative cheapness of the Welsbach light, however, is too great for the incandescent lamp to hold its own in a small town like Dessau, where the number of consumers able and willing to pay for the luxury of electric lighting is insignificant. This is the reason why the point of saturation for the latter has been so soon reached. Herr von Oechelhaeuser is further of opinion that in many places it is better to supply electricity for lighting by means of small block stations, wherein dynamos driven by gas-engines are put in the midst of the restricted areas in which a demand for the luxury may be found, than to spend capital upon large central stations, because the latter are always more exposed to the risk of losing their big customers when these discover that

small private plants can generate electricity more cheaply than it can be bought from the central station.

The truism that the first inventor of a successful process does not always get either the credit or the profit of his invention, is curiously illustrated by the experience of Mr. Hiram S. Maxim, whose glory as the originator of the incandescent electric lamp that formerly bore his name has been eclipsed by his other triumphs. From a recent communication by Mr. Maxim to a contemporary, it appears that his part in developing the commercial incandescent lamp was even greater than has been generally supposed, and that it is to him that the world owes the brilliant idea of "flashing" lamp filaments in an atmosphere of hydrocarbon gas, whereby inequalities of the substance of these filaments can be removed by the deposit of carbon in greater thickness upon the thinnest and consequently hottest places. Mr. Maxim narrates how he came to make this suggestion in a report to his then employer—Mr. Spencer D. Schuyler, of New York—so long ago as 1877. The idea was, of course, scouted as impracticable and dangerous by the practical electricians who heard of it. One of these, who it is alleged afterwards robbed Mr. Maxim of his property in it (the man is dead, and therefore it is hardly worth while to mention his name in this connection), went so far as to warn Mr. Schuyler that, if any experiments of the kind were made, he should leave the building, as they would be of a most dangerous character. It was further declared that, if Mr. Maxim had known anything of the matters he was dealing with, he would never have ventured to make such a suggestion; and that if he was permitted to go on he would kill himself, blow up the building, and inferentially lay New York in ruins. At this point of the proceedings, Mr. Maxim, who did not feel that he knew enough of chemical science to dogmatize, took further advice, and was assured that without oxygen it is impossible to explode hydrocarbon gases; and eventually he made his lamp and "flashed" his filaments. It would take too much of our space to repeat how, thanks to the imperfection in some respects of the United States patent law as compared with the British, and to the machinations of his rivals, the flashing process was patented but ultimately declared to be common property. How important the process was in the early days of incandescent lamp manufacture may be gathered from the statement that, whereas the original Edison lamps, which did not employ it, had a life of about 40 hours, this was immediately prolonged to 1000 hours by flashing. Mr. Maxim assesses at a million dollars a year his loss in connection with the fraudulent destruction of his patent right in the process; and yet he was not crushed.

At last it has been done; and Mr. Charles F. Scott has done it. We are not exactly clear as to what it is that Mr. Scott has done. But it must be something very fine, because two Professors—G. Forbes and H. A. Rowland, representing, as it were, the electrical science of two Continents—say so; and who are we that we should dispute their verdict? The matter in question appears to be that of a combination of the two-phase and three-phase systems, whatever this may be; and while Professor Forbes declared at the Washington convention of the National Electric Light Association of America that Mr. Scott's idea was an extremely beautiful one, and moreover appeared on the face of it to be a "feasible method," the other professional gentleman described it as one of the finest things that have come out in recent years. Another gentleman whom we may be excused for regarding as a competent authority, since we have never heard his name before, assured the meeting that it ought to think itself very lucky in having such a paper brought before it. Now it is with real reluctance that we find ourselves commenting, in what may appear to be a flippant strain, upon what is evidently a great leap in advance by American electrical science, especially as high seriousness is the most salient characteristic of Transatlantic technical journalism. But any delicacy we, as outsiders, might have felt in attempting to grapple with the meaning of Mr. Scott's discovery, is softened by the knowledge that what is Greek to us in the story is equally abstruse to the Editor of the *Electrician*, who is not ashamed to say in public that he is thankful for being permitted to escape from the obligation to deal with the paper otherwise than by abstracting it. We had thought that the cares of responsible electricians are riveted to such considerations as that of cheapening the cost of the unit, equalizing the load-line, ascertaining whether rope or direct driving is to be preferred for dynamos, and devising the best system of underground distribution. As our contemporary truly remarks, however, "it is difficult to appreciate the value of landmarks of history until time has allowed a true prospective view to be obtained;" and if Mr. Scott has at last enabled the electric light to be distributed at about the cost of gas, we shall be among the first to congratulate him upon the achievement.

Presentations to Mr. D. M. F. Gaskin.—The staff of the St. Helens Corporation Water-Works has testified, in a tangible way, to the high regard in which they hold their late chief, Mr. D. M. F. Gaskin, by presenting him with a silver tea and coffee service; and last week he was also the recipient of a handsome present from the heads of the various Corporation departments. Mr. Gaskin has been Borough Water Engineer for the past 17½ years; and on Wednesday he assumed the responsibilities of his new office at Nottingham.

THE REGULATION OF LABOUR IN GAS-WORKS.

One of the signs of the times that forces itself with ever-heightening prominence into the observation of those who are in the habit of surveying the world around them, is the tendency on the part of Government and the Legislature to assert control over the internal arrangements of industrial undertakings which are yet allowed to remain private property. Many examples of the operation of this tendency might be given in support of the general statement; but, for the present, we will confine ourselves to such as are actually or have recently been before Parliament. In the first place, there is to be noticed the Government Bill for "Providing for Notice of, and Inquiry into, Accidents occurring in certain Employments and Industries." This measure has been introduced by Mr. Burt, Mr. Mundella, and the Home Secretary, and has a fair chance of becoming law this year, if the length of the session is not itself summarily determined by an accident of a kind into which it will be unnecessary to inquire too closely. The schedule to the Bill mentions gas-works as coming under its purview; and ordinary house-building operations are also included within its scope, provided that such buildings exceed three storeys in height or 4000 feet in superficial area, or in and upon which more than twenty persons, not being domestic servants, are employed for wages. It is provided that where there occurs, in any employment to which the Bill applies, any accident which causes to any person employed therein either loss of life or such bodily injury as to prevent him from returning to his place and doing five hours' work on any day during the next three days after the occurrence of the accident, his employer shall, as soon as may be, and not later than four days after the accident, send to the Board of Trade notice of the occurrence. This notice is to contain a statement of the probable cause of the accident, the name and address of the victim, the mode in which any such person was employed at the time, and the nature of the injury.

This is a tolerably sweeping set of provisions; and they are calculated to impress employers with a sense of the extent to which we are governed now-a-days. At this rate, it will soon be necessary for every person who contemplates starting in business on his own account to first go to the Board of Trade and inquire as to what forms he may have to fill up, under penalty for default, in connection with the mishaps and mischances to which all industrial ventures are exposed. To return to the Bill, it appears, as might be supposed, that the giving of notice of accidents is but the preliminary step to what follows. Where it appears to the Board of Trade that any accident involving loss of life or bodily injury is of sufficient importance to require a formal investigation into causes and circumstances, the Board may direct such investigation to be held, and may make the necessary arrangements therefor. The Board may appoint a competent person to hold the investigation, and may appoint a legal or expert assessor. The investigation is to be held in open Court, according to the manner that shall be deemed most effectual for eliciting the facts. This special Court is to be endowed with all the powers of a regular court of summary jurisdiction, and with all the authority of an Inspector under the Railway Regulation Acts, 1840 to 1889, and, in addition, with certain powers of entry and inspection, powers for summoning persons and requiring the production of papers, and for administering oaths and taking signed declarations. These inquiries are to be conducted at the expense of the Board of Trade. This latter, however, is left an open question to be settled in Committee.

It may be declared, at the outset of our comment upon the provisions of this Bill, that we see no reason to object to the principle covered by them. Few institutions of this country have been more powerful in the promotion of good by way of deterring prospective evil-doers, and procuring the punishment of malefactors, than the Coroner's inquest, which, however, sometimes appears to need a little modernizing to make it answer to the conditions of the age. The Bill now under notice is nothing more than a project of legislation for establishing a modern kind of Coroner's inquest upon industrial accidents, with extension to cases where the injury to the person has not been actually fatal. It is also an improvement upon the system of works inquests which has been adopted by the South Metropolitan Gas Company and other large concerns (of course, without statutory sanction), merely with the object of getting at the facts of accidents, and eliciting suggestions tending to their prevention in the future. Attention has rightly been drawn in other quarters to the importance of the time-element in dealing with these matters. It is one of the best features of the Bill that it requires notice of every accident to be given to the Board of Trade within four days; because it is notorious that employers are often victimized by having actions for compensation for personal injuries brought against them long after the event, and frequently after those who are best qualified to speak to the facts have left their employment. If the Bill becomes law, every accident will be made the subject of inquiry within a week or so of its occurrence, when a record will be made which will form the best guarantee that subsequent proceedings shall be based upon fact. This consideration should outweigh any objection that employers might be disposed to raise against the proposal on the score of its giving them additional trouble.

It might be suggested that employers coming under the Act should post on a board, fixed in a conspicuous place, copies of notices given and received in accordance with the provisions of the statute. Indeed, a board for such purpose is a necessary fitting of a modern factory, and might, by a pardonable pun, be called the Board of Trade. On the whole, there does not appear to be any valid reason why employers of labour as an order should oppose this scheme of legislation.

Something very different must be said of the next measure calling for notice as a specimen of projected labour legislation actually awaiting the consideration of Parliament. This is an old friend, or rather an old enemy, to which we had occasion to refer some time ago by way of supporting the argument for the formation of a Gas Undertakings Association for watching parliamentary proceedings. It was called last year the Hours of Labour (Crown, &c., Servants) Bill, and under such a title it might have been overlooked by employers of labour in branches of the public service not yet wholly divorced from industrial conditions. This year the promoters of the Bill are more candid; and they now call their proposal the Hours of Labour (Local Authorities, &c., Servants) Bill. It is the old scheme, however, with a preamble reciting the "facts" that the supply of labour throughout the United Kingdom is, under existing conditions, greater than the demand; that this over-abundant supply of labour is largely due to the excessive hours of labour to which those who find employment are subjected; that whereas, on the one hand, excessive hours of labour, and, on the other hand, enforced idleness, are morally and physically injurious to the whole body of labourers; and that "whereas it is desirable and expedient, in the interests of labourers and in the interests of the commonwealth, to adjust the demand for labour to the supply"—it is therefore to be enacted that no person in the service of a local authority, gas company, water company, electric lighting company, or omnibus company, shall work for a longer period than eight hours in any one day, or for more than forty-eight hours in any one week. Any local authority, or the principal officer of such authority, ordering or requiring any person in public employment to remain at work for more than eight hours in any one day, or forty-eight hours in any one week, except in case of special unforeseen emergency, is to be liable to a fine of £10. A record of these emergency employments is to be kept; and a complete list of the cases is to be published once a year in at least three local newspapers. If a company transgresses the ordinance, however, the general manager is to be fined £50. A separate clause in the Bill defines the term "special unforeseen emergency" to mean "an unexpected occurrence involving the safety of person or property." This is useful and kind on the part of the promoters; but what is to be thought of the men who play at projects of legislation of this insensate character, and instigate the waste of public money and time upon their printing and promotion? This is to reduce the Imperial Parliament to the level of certain Transatlantic and Colonial legislative assemblies, to which demagogues are sent in order that they may talk to their hearts' content, on the sole condition of not doing anything else.

The only other matter that has recently engaged the attention of Parliament which we desire to mention here is the fruitless debate in the House of Commons upon the question of old age pensions. One effect of all these Bills and discussions upon industrial and economic subjects is to foster the growth of the sentiment of solidarity in different industries. Whether it is a question of the State regulation of the hours of labour, or what not, the first thing a manufacturer or factory owner thinks of is the bearing which the project under examination may be expected to have upon his particular class of business. The consideration of how it may affect him individually is a secondary and minor care; for inter-industrial rivalry cannot be greatly touched by anything that applies to every concern in the same trade. This is the simple explanation of why manufacturers and traders mutually competing with one another for business seldom fail to present a united front against prejudicial legislative interference. Most unfortunately, gas undertakings in this country are not so united; and if Eight-Hour Day fanatics were permitted to have their will of them, they might soon reduce them one after another to submission. It is of little use to offer the aspiration; but we really should like to see this question of old-age insurance taken in hand voluntarily, by the associated gas companies of the country, if it were only to show that employers of this particular kind of labour need not to be driven to act in such a matter by statute. We all know what the German gas undertakings are compelled to do by law; and the only objections to this system worthy of regard are that there is too much red-tape about it, and that the benefit conferred upon the workman is not sufficient. This is a matter that cannot be dismissed by referring to the responsibility of workpeople for providing for their own future. The advantages of thrift are undeniable, and they remain for those who have it within their power to benefit by them. The point to which humanitarian public opinion is tending, however, is that, out of the surplus value of a man's labour over and above his wages, the employer ought to make provision for redeeming the outworn toiler from the fate of the worthless pauper. And the first order of employers upon whom the weight of this public opinion will fall are those whose profits are protected and guaranteed by the law of the land. That a statutory gas company paying 10 per cent. and more to the original proprietors, or a municipal authority owning gas-works, should consign their spent human material to the workhouse, is an idea against which the community will rightly revolt; and it would be well if the cause of reproach were to be spontaneously removed by systematic and concerted action on the part of those most nearly concerned.

Mr. David T. Livesey, late of the Aldershot Gas and Water Company, has been appointed Manager of the gas-works of the East Grinstead Gas and Water Company.

An Interesting Discovery at Linlithgow.—While making some excavations in the streets of Linlithgow recently, the workmen engaged came across the old water-supply pipe connected with Linlithgow Palace. The pipe, which is of the material known as "virgin" lead, bears the date 1538; being the year in which the first gravitation water supply is said to have been introduced in Scotland.

Electrolysis of Water-Pipes.—Corrosion of water-pipes and other underground furniture by the ground return of electric railways continues to be observed. The recent annual report of the Brooklyn Electrical Subway Commission states that discoveries of corroded water and gas pipes have been of late so numerous, that there seems no escape from the conclusion that metal pipes of all kinds extending below the surface along the routes of the trolly cars are being in many places destroyed by the ground currents. *Engineering News* says that at Peoria (Ill.) the Water Company have formally notified to the city authorities that their mains are being injured by the currents from the street railways; and unless these ground currents are removed, the Company will refuse to further extend their mains, or be responsible for the maintenance of those now laid.

Books Received.—"Gas Engineer's Laboratory Handbook," by John Hornby, F.I.C. (London: E. and F. N. Spon.) This work is the production of a member of the staff at Beckton, who is an Honours Medallist in "Gas Manufacture;" and it is dedicated to Mr. John Methven, in recognition of his uniform courtesy and kindness. The subject-matter is divided into five parts; and an appendix contains a number of useful tables for all who are engaged in gas-testing. In the production of his book, the author has derived considerable assistance from works already published; and due acknowledgment is made of this help.——"Nature's Hygiene: A Systematic Manual of Natural Hygiene," by C. T. Kingzett, F.I.C., F.C.S. (London: Baillière, Tindall, and Cox, King William Street, Strand.) This is the fourth edition of Mr. Kingzett's interesting work, which first appeared in 1880; and the author has endeavoured to make it more comprehensive than its predecessors. As he says in his preface, it has gradually grown from a series of scientific essays into a systematic treatise on hygiene. In the preparation of the additional matter, he has had considerable help from his assistant, Mr. D. Homfray, B.Sc.

Colour Tests.—In the discussion which followed the reading of Mr. J. W. Lovibond's paper on "Colour as a Means of Quantitative Estimation" at the meeting of the London Section of the Society of Chemical Industry on the 2nd inst., one speaker pointed out that the presence of sugar in solution increases the intensity of tint of lead sulphide in suspension by even as much as ten times. Hence in the estimation of lead as sulphide by the tintometer, it was, he said, necessary to work with sugar-free solution, or solutions of the same strength throughout. We do not recollect, at the moment, if the lead solution for Harcourt's sulphur test is made up as a syrup for the main object of retaining the sulphide in suspension, or for the purpose of increasing the delicacy of the test; but the fact that the quantity of sugar in solution affects the intensity of the coloration points to the necessity of adhering implicitly to the instructions for diluting the strong syrup supplied for the test. If more or less than the prescribed quantity of water is added to the syrup, it would appear that the results are vitiated, though at first sight this might not be expected. Carelessness in this respect is by no means uncommon, even where the testing is supervised by a qualified chemist.

Petroleum Borings in North Caucasus.—The fact that naphtha is being found in Northern Caucasus, especially in the Grosnoje district, has, says *Engineering*, already for some time been attracting attention, the more so as the Wladikowkas-Petrowsk Railway has made the access to these parts much easier. Recent borings have given exceedingly satisfactory results. In October last a boring, within the Grosnoje naphtha district, was carried to a depth of about 440 feet; and the yield was exceedingly good, both as regards quantity and quality. This was quite a new departure, for up till then there had only been used small pits, dug in the ground, similar to those at Baku in earlier days. The quantity taken from the boring in four days amounted to about 3280 tons; and it would probably have been larger had there not, through faulty connections in the pipe, been mixed with the naphtha a considerable amount of water from the upper layers of the soil. The naphtha was collected in a reservoir dug in the earth, capable of holding some 10,000 tons; and its further treatment proved it to contain more kerosene and less residue than the Baku naphtha. It has been decided to put down a pipe from the springs to Grosnoje. Besides the bore-hole above referred to, two more were made, 20 inches and 9 inches respectively diameter; and further borings are contemplated.

ACCOUNTS OF THE METROPOLITAN GAS COMPANIES FOR THE YEAR 1893.

—	Chartered.	Commercial.	South Metropolitan.	All the Companies.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Capital and borrowed money	12,169,250 0 0	880,000 0 0	3,276,417 0 0	16,325,667 0 0
Income—viz.:				
Sale of gas by meter	2,628,872 16 11	254,230 2 2	741,337 3 4	3,624,440 2 5
Public lighting, including lighting under contracts	145,325 13 8	18,825 16 11	59,898 8 1	224,049 18 8
Rental of meters and stoves	75,805 13 4	5,725 16 0	26,829 16 5	108,361 5 9
Residual products	730,769 9 3	94,404 10 1	300,254 6 5	1,125,428 5 9
Miscellaneous, including old materials	14,165 18 6	719 1 10	5,683 10 11	20,568 11 3
Total income from all sources	3,594,939 11 8	373,905 7 0	1,134,003 5 2	5,102,848 3 10
Expenditure—viz.:				
Coals, including carriage and dues	1,211,612 18 6	134,029 12 3	384,227 17 8	1,729,870 8 5
Purifying materials, including labour	60,349 0 1	8,123 18 10	19,488 9 7	87,961 8 6
Salaries and wages—manufacture	346,682 4 10	40,982 11 1	110,971 7 0	498,636 2 11
Wear and tear—manufacture	335,043 17 10	36,912 10 7	108,678 8 8	480,634 17 1
Rents, rates, and taxes	185,114 16 9	11,566 15 9	39,612 4 8	236,293 17 2
Salaries—management	15,921 15 11	2,232 12 0	3,831 17 9	21,986 5 8
Collectors' salaries and commission	30,284 4 4	2,931 18 11	9,929 13 11	43,145 17 2
Stationery, printing, and general charges	11,334 3 0	1,730 5 0	9,912 18 4	22,977 6 4
Directors and auditors	5,900 0 0	2,650 0 0	3,725 0 0	12,275 0 0
Salaries and wages, wear and tear—distribution	137,124 19 10	16,229 13 9	53,820 17 2	207,175 10 9
Repair and renewal of meters and stoves	81,839 1 1	5,021 8 5	23,200 16 3	110,061 5 9
Law and parliamentary charges	19,249 13 6	672 8 8	6,014 8 11	25,936 11 1
Bad debts and extraordinary expenses	42,621 8 8*	3,279 1 11	25,770 12 4†	71,671 2 11
Total expenditure on revenue account	2,483,078 4 4	266,362 17 2	799,184 12 3	3,548,625 13 9
Gross profit	1,111,861 7 4	107,542 9 10	334,818 12 11	1,554,222 10 1
Do. per cent. on capital and borrowed money	9 2 9	12 4 5	10 4 5	9 10 5
Do. do. gas-rental	40 1 7	31 0 7	41 15 8	40 7 9

* Including £21,262 annuities.

† Including £14,394 19s. paid under profit-sharing scheme.

TABLE *showing the Capital, Income, Expenditure, and Profit, per Ton of Coal carbonized, in* 1893.

—	Chartered.	Commercial.	South Metropolitan.	All the Companies.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Capital and borrowed money	6 8 5·16	4 2 6·67	4 12 10·81	5 16 0·57
Income—viz.:				
Total gas-rental	1 9 3·33	1 5 7·39	1 2 6·82	1 7 4·27
Rental of meters and stoves	9·60	6·45	9·13	9·24
Residual products	7 8·55	8 10·28	8 6·16	8 0·00
Miscellaneous, including old materials	1·80	0·81	1·94	1·76
Total income from all sources	1 17 11·28	1 15 0·93	1 12 1·85	1 16 3·27
Expenditure—viz.:				
Coals, including carriage and dues	12 9·44	12 6·89	10 10·73	12 3·56
Purifying materials, including labour	7·64	9·15	6·63	7·50
Salaries and wages—manufacture	3 7·91	3 10·14	3 1·76	3 6·53
Wear and tear—manufacture	3 6·43	3 5·55	3 0·98	3 5·00
Rents, rates, and taxes	1 11·44	1 1·02	1 1·48	1 8·16
Salaries—management	2·02	2·51	1·30	1·87
Collectors' salaries and commission	3·84	3·30	3·38	3·68
Stationery, printing, and general charges	1·44	1·95	3·37	1·96
Directors and auditors	0·74	2·98	1·27	1·05
Salaries and wages, wear and tear—distribution	1 5·37	1 6·27	1 6·31	1 5·67
Repair and renewal of meters and stoves	10·36	5·65	7·90	9·39
Law and parliamentary charges	2·41	0·76	2·05	2·22
Bad debts and extraordinary expenses	5·40	3·69	8·77	6·11
Total expenditure on revenue account	1 6 2·47	1 4 11·86	1 2 7·93	1 5 2·70
Gross profit	11 8·81	10 1·07	9 5·92	11 0·57

TABLE *showing Increase or Decrease in each Item during* 1893 *compared with* 1892.

—	Chartered.		Commercial.		South Metropolitan.		All the Companies.	
	Inc.	Dec.	Inc.	Dec.	Inc.	Dec.	Inc.	Dec.
	£	£	£	£	£	£	£	£
Capital and borrowed money	110,500	..	..	..	73,200	..	183,700	..
Income—viz.:								
Sale of gas by meter	..	153,910	10,133	..	..	26,951	..	170,728
Public lighting, including lighting under contracts	..	242	86	..	364	..	208	..
Rental of meters and stoves	1,567	..	209	..	2,247	..	4,022	..
Residual products	31,437	..	15,823	..	21,208	..	68,469	..
Miscellaneous, including old materials	537	..	..	59	..	141	337	..
Total income from all sources	..	120,611	26,192	..	..	3,273	..	97,692
Expenditure—viz.:								
Coals, including carriage and dues	..	212,125	..	23,142	..	59,957	..	295,224
Purifying materials, including labour	..	14,251	..	1,139	..	3,385	..	18,775
Salaries and wages—manufacture	..	5,684	..	2,664	..	3,853	..	12,201
Wear and tear—manufacture	6,711	..	7,435	..	13,953	..	28,099	..
Rents, rates, and taxes	22,641	..	..	103	3,956	..	26,494	..
Salaries—management	..	1,626	14	..	56	..	..	1,556
Collectors' salaries and commission	711	..	..	51	382	..	1,042	..
Stationery, printing, and general charges	..	940	..	262	538	..	..	664
Directors and auditors	..	..	..	..	..	..	..	..
Salaries and wages, wear and tear—distribution	2,242	..	3,795	..	2,101	..	8,138	..
Repair and renewal of meters and stoves	516	..	931	..	8,488	..	9,935	..
Law and parliamentary charges	3,387	..	152	..	5,587	..	9,126	..
Bad debts and extraordinary expenses	3,008	..	411	..	7,668	..	11,087	..
Total expenditure on revenue account	..	195,410	..	14,623	..	24,466	..	234,499
Gross profit	74,799	..	40,815	..	21,193	..	136,807	..
Do. per cent. on capital and borrowed money	£0 10s. 9d.	..	£4 12s. 9d	..	£0 8s. 7d.	..	£0 14s. 9d	..
Do. do. gas-rental	4 13 3	..	5 12 10	..	3 17 11	..	5 2 4	..

THE TREATMENT OF SEWAGE BY ELECTROLYZED SEA WATER.

Some experiments have lately been carried on at Worthing with M. Eugène Hermite's system for treating sewage by electrolyzed sea water, which has already been tested, and said to have been tested satisfactorily, at Havre, L'Orient, Brest, and Nice. The Hermite process is briefly as follows: Sea water (or an artificial solution of magnesium and sodium chloride) is electrolyzed. An oxygenated compound of chlorine is thus obtained, which it is claimed destroys sulphuretted hydrogen, sulphydrate of ammonia, and microbes of all kinds. This disinfecting liquid it is proposed to supply, as water and gas are furnished, to each separate house, to be used for flushing the closets, and, if so desired, for washing purposes, especially when there is sickness in the house. Such a supply will diminish materially, as is pointed out, the quantity of drinking water required.

The foregoing is the whole system, as explained in the printed slip handed to us on the occasion of a recent visit. But it is not quite what we saw carried out, for there was a sewage receiver between the closets and the sewer, which, although not referred to in the system as described, could hardly be done without. Sea water is supplied by water-carts to two cisterns, each one cubic metre in capacity. The electrolyzer, which is about 1-25th of the size of the cisterns, contains a number of circular discs of zinc fixed on to a central axle, which is rotated by a belt from a steam-engine. Fixed to the electrolyzer are thin platinized sheets, each of which passes between two of the zinc discs. Another belt drives a centrifugal pump, by which the water is made to circulate between one of the cisterns and the electrolyzer. A third belt drives a dynamo, the current from which is connected up to the zinc and platinized electrodes respectively of the electrolyzer, and thus decomposes the water contained in it. The water is circulated through the tank and electrolyzer, until it contains about 1 gramme of chlorine to the litre of water (1 part per 1000), when it is pumped up to a reservoir, from which it passes by gravitation to waste-preventers in closets.

There were two closets in a yard, said to be used by from 20 to 30 persons daily, and 14 cottages in West Street, supplied with this disinfecting liquid from the reservoir. Each waste-preventer flushed out 2 gallons of water when brought into operation. Between the closets and the sewer was placed a syphon chamber receiver of the following kind: Two circular galvanized iron vessels were connected below by means of a syphon—the second one delivering its contents from its upper edge into the sewer. The first vessel contained a second smaller perforated vessel placed centrally within it, so as to leave an annular space between the two. The liquid stood at the same height in both the larger vessels. The matter from the closets was discharged into the central smaller receiver, where it was always under the action of the disinfecting decomposing liquid, which was said to have the effect of eating up the solid matter, and thoroughly sterilizing both it and the liquid matter passing into it. The liquid which flowed away from the second receiver was considered as the effluent. The writer saw a sample of this delivered to a chemist for analysis, which he took under protest. It was of a chalky-white colour, and was said to be all that remained of the filth that passed away from the closets and cottages. The liquid in the syphon connected with the cottages was more discoloured than that passing from the two closets. This was said to arise from the very mixed character of the sewage delivered into it.

From a scientific point of view, the whole question appears to lie in a nutshell. M. Hermite produces in a certain way a disinfecting fluid. It contains, it is stated, an oxygenated compound of chlorine, 1 gramme to the litre; and it loses 20 per cent. of its active principle in 24 hours. It has to be used as soon as prepared; but, at all events, if employed within the time mentioned, 80 per cent. of its good qualities will remain. M. Hermite will doubtless be willing to supply this disinfecting liquid in stoppered bottles for chemists and bacteriologists to test quietly in their laboratories. Excreta, for instance, could be shaken up in a closed vessel containing the necessary quantity of the disinfecting liquid. In this way the minimum time required for its decomposition could be observed. Of course, so quick an action could not, under the most favourable circumstances, occur in the arrangement set up; and if any closets connected with a particular syphon chamber were used frequently in sequence, it would be almost impossible for undissolved solid excreta not to pass through the second receiver into the sewer. Another matter to remember is that the liquid used is a well-known bleaching solution, and has been successfully used for this purpose for years; and therefore it does not follow that a white-coloured effluent is necessarily disinfected. It may or may not be. That the effluent is not clear, was evident to everyone who saw it in a glass vessel; and there is no physical or chemical reason why it should not precipitate solid matter later on in the sewers.

We do not wish to "throw cold water" on this invention. M. Hermite makes no small claim on the engineering profession when he asks them to support him in proposing a duplicate system of water supply. There is no question that, from many points of view, he is recommending what is theoretically correct. He must, however, satisfy engineers that his liquid does what it is claimed to do; and we venture to think that, whether or not the chemist and bacteriologist are satisfied, the engineer will require to know more than he can learn from the Worthing experiment before he can recommend the system.

Since the foregoing article was written, a report on the process, by Dr. Kelly, Medical Officer of Health for Worthing, prepared at the request of the District Sanitary Committee, has been presented to the Town Council; and it has recently been discussed at great length at a meeting of that body. The report was of a most elaborate nature, and contained the results of chemical and bacteriological analyses made respectively by Dr. Dupré and Dr. Klein. Dr. Kelly did not go into the question of cost; but he pointed out that, in addition to the annual expense of producing sufficient electrolyzed fluid, very great outlay would be necessary to put down a fresh set of mains, pipes, and cisterns, so as to convey it to each house. He summed up his conclusions as follows: "Since there is no instantaneous decomposition of fæcal matter and no sterilization of sewage, I am of opinion that the process, as far as the late trials have gone, has therefore failed to produce the results which are claimed for it by its inventor." Reports on the process are being awaited from Sir H. Roscoe and Dr. Ruffer.

NOTES.

Pressure Ventilation Systems.

Writing to the *Engineer* on the subject of Mr. Rigg's ideas on ventilation (see *ante*, p. 567) Mr. Frank Ashwell, of Leicester, remarks that up to the present the "plenum" system advocated by the former gentleman has been chiefly adopted for asylums and Board schools, for both of which classes of buildings its success is assured. The main points of a successful plenum system of ventilation are summarized by this writer as follows: The incoming air must be obtained from a fresh and pure source, preferably from a tower of some considerable height, arranged so that the air can enter it from all four sides. This air should be filtered at the inlet, if in a town, and the screen or filter arranged with an apparatus for washing it with water. The trunk air-mains underneath the building should be large enough to admit a man to walk through them; and they must be so built and lined as not to harbour dust. If possible, they should be well lighted. The heating surface, disposed in chambers off the main trunk, must be so arranged as to admit of cleaning. As far as possible, the air should ascend in vertical flues directly from the main trunk, with no small horizontal flues which cannot be got at for cleaning. The velocity of the air at its entrance into the rooms must not be great enough to cause draught or noise. In most cases, Mr. Ashwell advises that the inlet should be 8 feet from the floor. An air-inlet on the inside wall in one corner of a schoolroom or ward, with the outlet at the bottom and on the other side of the room, are found to give perfect diffusion without draughts. In most cases, Mr. Ashwell recommends that there should be an outlet at the ceiling level as well. He thinks there is nothing like a well-designed and well-managed plenum system of ventilation for schools; for by such means from 1500 to 2000 cubic feet of fresh warmed air per head can be passed into class-rooms without creating unpleasant draughts. He says it is a mistake, however, to consider that with a system of this kind the extraction can be left to take charge of itself. This is not the case; and great care is requisite in properly arranging the flues, and seeing that the terminal outlet is free on all four sides.

Testing for Explosive Gaseous Mixtures.

A machine for testing explosive mixtures of air and inflammable gas has been invented by Mr. Thomas Shaw, of Philadelphia. The apparatus, which is illustrated and described in *Engineering News*, has been designed to indicate the presence of gas in the atmosphere, and to afford a means for determining its quantity. The principle depended upon by Mr. Shaw is that the limit of inflammability of a gas in air is a quantity capable of being defined with great exactness. In the apparatus there are two cylinders set in the same line, and containing plungers connected with the same working beam. One of these cylinders is for air, and is stationary, with a constant stroke. The other is for gas, and is capable of being moved through a considerable length of the working beam, whereby it can be made to take a stroke of any desired length, and to pump any percentage of the volume of the air cylinder. The discharge from the two cylinders passes into an igniting chamber, which has an outlet on one side in front of a gas-jet. Should the mixture pumped into this chamber be explosible, ignition will take place, and the consequent expansion will force a loose piston-head against a gong or bell, and produce an audible signal. The operation of the machine is as follows: Supposing it is desired to test for the presence in air of an illuminating gas, having an igniting limit of 8·1 per cent. The gas cylinder is attached to a source of the illuminating gas, and adjusted to pump 8·1 per cent. of it as compared with the capacity of the air cylinder, which is supplied with the air to be tested—that is to say, of the combined product of the two cylinders, 8·1 per cent. will be gas, and the remaining 91·9 per cent. will be air. Now, if the atmosphere under examination contains any gas, it is evident that this, added

to the 8·1 per cent. of pure gas already in the mixture, will raise the proportion of gas in the combined product of the two cylinders above the igniting-point. Consequently, there will be an explosion, and the bell will ring. To determine how much gas the air contains, the proportion of pure gas pumped is then gradually reduced until the mixture will no longer ignite. Supposing this happens when 7·6 per cent. of the pure gas is pumped. Then 8·1 − 7·6 = 0·5 per cent. of gas is contained in the atmosphere tested.

The Organic Matter in River Water.

A communication on "The Natural Diminution of the Dissolved Organic Matter in the Water of Rivers" was made to the London Section of the Society of Chemical Industry on the 2nd inst., by Mr. W. C. Young. The results of determinations of the total organic matter dissolved in a number of samples taken at different spots on the River Lea, between its source and the intake of the East London Water Company, were given. The samples were taken under the conditions most favourable to the organic purity of the water—*i.e.*, after two or three weeks of dry summer weather. The water from the tributary streams had a marked influence on that of the main stream at points slightly below the confluence. The water appeared to have the greatest freedom from dissolved organic matter at a spot near the East London Water Company's intake. The author found also that the water improved in purity during the period of about 18 days required for its transport from the intake on the river to the consumer. A number of tests showed that the dissolved organic matter diminished from 0·385 grain per gallon at the intake to 0·264 grain on delivery. In order to ascertain if the diminution was attributable to atmospheric oxidation, two samples of impure water were agitated daily in such a manner as to expose them freely to air for long periods. One of the samples, containing 4·9 grains of dissolved organic matter per gallon, contained only 1·7 grains, after treatment in this manner for six weeks; but the water had become thickly clouded by a green vegetation. On removing this growth, and continuing the treatment for five weeks more, a slight further vegetation developed; and the dissolved organic matter decreased to 1·1 grains per gallon. Another sample of impure water dropped only from 3·6 to 3·5 grains of dissolved organic matter during the first period; but no vegetation appeared in it, though at the end of the second term, during which growth took place, the dissolved organic matter only amounted to 2·2 grains. Samples of sewage which were kept in stoppered bottles in a bad light for 18 months, in which time a microscopic growth occurred in them, showed also a remarkable diminution in their content of dissolved organic matter. Mr. Young believes that the development of fungus in water has a great effect on the dissolved organic matter—even removing as much as 70 per cent. in three weeks. He concludes that atmospheric oxidation is almost negligible in its action on the dissolved organic contents of water; but, on the other hand, the growth of vegetation has a very marked effect. The paper was discussed by Messrs. W. Thorp and D. Howard, and also by Dr. Dupré; the latter subjecting it to a most aggressive criticism, in which he attributed the natural purification of river water almost solely to the activity of microbe organisms.

The Forthcoming Meeting of the Societe Technique.—We learn from the current number of the *Journal des Usines à Gaz* that the forthcoming congress of the Société Technique will be held about a month earlier than usual. The meeting is fixed to take place at Nîmes, under the presidency of M. Paul Mallet, on the 16th of May and the following days. As usual, the first two days will be devoted to business; and the remainder of the time to excursions. The members will be invited to a banquet by the Continental Union Gas Company; and there will be the customary subscription banquet. Among the interesting features of the meeting will be a conference with M. Crova on photometry. Trips are projected to Arles, with a run down the Rhône; and also to the Lyons Exhibition, where the grill-room fitted up by M. Garnier, and described by him in a communication presented at the last meeting, will be inspected.

The Late M. Jablochkoff.—Major Flood Page has sent to *The Times* a few particulars respecting the late M. Jablochkoff, whose death was noticed in the JOURNAL last week. He says: "There is no doubt that he did a great deal in directing the attention of the very small body of electricians in 1876-7 to the practicability of electric lighting; and much credit is due to him for his original work, and for the advance he made. For some time his electric candle held its own, and was undoubtedly the best system then in existence. It is still in use in Indian mills and many other places. In spite of the fact that he was supported in St. Petersburg by an illustrious personage, this clever Russian officer was not a successful man, as men count success. Nevertheless, that St. Petersburg, which was behind the other capitals in the use of gas, and Moscow, which was not lighted by gas till 1866, have their central electric stations, and palaces, houses, and streets electrically lighted, is in no small measure due to the interest taken in M. Jablochkoff, and the impetus given to electrical advance in Russia by his original work. Like many inventors, he was very sanguine, and was, I am afraid, a very disappointed man."

COMMUNICATED ARTICLE.

THE DEVELOPMENT OF THE GASHOLDER.

By A. M'I. Cleland.

II.

In the previous article, the development of the gasholder was traced up to the time at which the bell left the hands of Malam; although, for chronological reasons, it was necessary to notice the introduction of the telescopic holder, with its hydraulic cup or lute. The present article will deal with the further development of the bell, and also of the guide-framing; the latter being taken first.

As before stated, the guide-framing of the gasholder was not seriously considered for some years after the appearance of the first edition of Peckston's "Treatise." Indeed, it was not necessary that it should be, as the framing of the earlier holders occupied but a secondary position compared with the bell. All that the holders of 1819 required was a couple of cast-iron columns, or two pairs of flanged pipes, bolted down to the tank, and tied at the top by a plank or two, along which ran a chain, one end supporting the balance-weight, and the other attached to the centre of the roof of the bell. This was considered amply sufficient "framing" for the 15,000 to 20,000 cubic feet holders recommended for large works in Peckston's time. But when gasholders were built out in the open; when they were telescoped, and began to assume rather larger proportions; when, in fact, instead of being merely suspended, they had to be guided as well—the proper design of the framing became a subject of importance.

At one time, the most popular style of guiding the bell would appear to have been to erect a number of cast-iron tripods, equally spaced, around the tank, and with good broad bases, so that it was unnecessary to tie them at the top. This method was only applied to single holders, which in some cases reached the respectable diameter of 100 feet. These tripods, however, were costly and extremely ugly; and they were soon superseded by a more graceful arrangement of hollow cast-iron columns, with ties of wrought bars or some simple form of cast girder. Extreme lightness was the main characteristic of this early framing—columns less than 6 inches in diameter, their tops connected by flat bars of 3 inch by ⅝ inch section, were frequently to be met with. Most of these columns were required to have (quoting from an old specification) "a tongue cast on of uniform thickness, and quite free from any irregularities or windings, as it is for the guide-wheels to run against"—a device now altogether antiquated.

As a rule, all holders (whether single or telescopic) erected prior to the year 1840 were counterbalanced; and it was frequently specified that the adjustment of the weights was to be such that the holder should not give more than an inch to an inch-and-a-half pressure—just sufficient to work the district; although in one instance the extremely low pressure of 3-10ths was stipulated for. But with the growth in the dimensions of the holders themselves, the advent of Grafton's exhauster, the introduction of a more reliable and delicate station governor, and last, but not least, the steady expansion of the districts of supply—necessitating, as it did, a higher initial pressure at the works—counterbalancing was found to be unnecessary, and in many cases the weights were removed altogether. In not a few instances, the weight of the holder required to be increased, which was done by fixing cast-iron blocks to the bottom curb; or, in the case of a new holder, by increasing the thickness of the sheeting. This latter method also possessed the advantage of adding to the durability of the holder.

Another form of guide-framing very much in vogue 50 or 60 years ago was one which gave greater scope for architectural treatment than any previously adopted. This was an arrangement of twin columns, mounted on the same base; the diameter of the columns varying from 9 to 12 inches. In a two-lift holder, every standard (of a pair of columns each), rising from a square pedestal, would be divided into two or three parts by entablatures, which, with the pedestals, were cast with suitable and clearly-defined mouldings. The tops of the standards were braced together by means of cast-iron girders, which were at times strengthened by some simple form of trussing.

Gradually, however, the guide-framing settled into one stereotyped design, examples of which are to be met with in course of erection even to the present day. A series of independent posts was employed, spaced round the circumference of the tank at intervals of 25 to 30 feet, with horizontal connecting girders and light diagonal ties, giving the whole structure a much more solid and rigid appearance than the older style of light twin-columns. These posts were generally of cast iron, circular in section, the diameter decreasing from bottom to top, the metal varying from ⅜ inch to 1¼ inches in thickness, cast in lengths of not less than 10 feet each. The flanges, which were machine-faced, connecting the various lengths, were either internal, so that the shafts might present an unbroken outline exteriorly; or external, to permit of ready and easy examination and inspection. Such columns have been erected as high as 108 feet; the height being divided, as formerly, by tastefully designed entablatures. The shafts rose from bold, heavily-moulded bases, and were usually surmounted by light and graceful finials. In some few instances the lengths of the columns, if the latter were but short, were

connected by means of "a socket joint and spigot, which could be turned in a lathe with the greatest accuracy; and the joint was secured with iron cotters. This made a very good joint; and, when painted, it was almost invisible."

Occasionally, however, the posts, stanchions, or standards, instead of being columnar, were of T section, tapering from base to cap, cast in suitable lengths, and having their heavy appearance somewhat relieved by openings in the webs. An excellent example of this style of framing is to be found at the Blowick works of the Southport Corporation, designed by Mr. George Anderson, and illustrated in "King's Treatise." Owing to the very exposed position of these works, which are situated in an extremely flat district, and in close proximity to the Irish Sea, the standards of this framing are placed somewhat closer together than usual, being less than 20 feet apart.

The girders which connected the columns or stanchions at their tops or intermediate entablatures were either of cast iron, with open webs, or of wrought-iron trelliswork; though instances are occasionally met with in which a somewhat doubtful combination of wrought and cast iron has been used, the use of composite girders of this class having been patented in 1858* by Joshua Horton, who claims great economy in their manufacture. An example of the above is to be seen in the top tier of girders of one of the holders belonging to the Kennington Lane works of the South Metropolitan Gas Company, in which the webs are of cast iron and the flanges of wrought iron.

The diagonal ties which are occasionally seen in each bay formed by the columnar style of framing, were probably introduced more with a view to produce a better artistic effect, or to make the framing appear stronger, than with any serious idea of adding stability to the structure. They are generally far too light to be of much practical use to the framing to which they are attached; but, when standards of a T section are employed, diagonal bracing is more necessary, on account of the smaller amount of lateral stiffness possessed by such standards. This style of framing found many warm admirers in the past; and it is still used to a large extent for holders of moderate dimensions—engineers merely differing as to whether columns or flanged standards should be adopted. Even so competent an authority as Mr. F. S. Cripps has a word of praise for it. He says: "It has its good points, however. Owing to the heavy, strong, and widespread based standards found necessary, it is better able to preserve rigid guiding for the free working of the holder than the light, springy framing, which depends upon the holder to a much greater extent for its preservation of form and lateral stiffness."† At the same time, others were found who condemned the columnar system out and out; one eminent engineer stigmatizing it as being neither architectural nor mechanical.

With regard to the guiding of the bell in its framing, several difficulties were met with at a very early date. So long as the bell was small enough to be suspended freely from the centre, it rose and fell smoothly enough, assisted by its single balance-weight. But when it grew large enough to necessitate its being suspended at three or four points around the circumference, by as many counterbalances and pulleys, it frequently happened that, owing to unequal friction or weight, one counterpoise would ascend or descend more rapidly than its neighbour; and, as a consequence, the bell would be tilted, and perhaps some loss of gas would result. Here again the genius of Malam devised means of surmounting this difficulty also. As early as 1823, we find him‡ proposing to use a combination of pinions, horizontal shafts, and bevel-wheels, fixed on the roof of the holder, and geared into racks cast on the inner edge of the tripods carrying the balance-weights. These various wheels and shafts were so arranged that all the counterbalances were compelled to ascend or descend at the same rate; and tilting was thus avoided. This ingenious contrivance was unexpectedly again brought to the notice of the gas world in 1892, during the hearing of the celebrated litigation case of *Gadd v. The Mayor, &c., of Manchester*,§ when "British Patent No. 4832, A.D. 1823," was a very prominent witness on behalf of the defendants.

With the growth in the size of the bell, and the increase in the number of points of suspension, the risks of tilting were so far minimized that it was no longer necessary to regard them. The bell was then guided by two sets of wrought-iron rods; those of the first set being attached at their upper and lower ends to the side of the tank, midway between the standards, and passing freely through eyes fixed on the bottom curb of the holder. The rods of the second set were connected with the standards, and passed between the prongs of forks riveted or bolted to the crown curb.

Grooved rollers were sometimes used for single holders, instead of eyes and forks; and they worked against the rods, or the "tongues" on the cast-iron columns before referred to. But these rollers frequently coming off the guides, and the introduction of the telescopic holder rendering forks and eyes inapplicable, the well-known roller, with convex face working in perfectly plumb channel guides, was adopted instead. One peculiarity sometimes to be met with in the arrangement of the guide-rollers of the earlier telescopic holders is the turning inwards of the roller attached to the grip of the outer holder, so that its flange pressed against the outside of the inner holder, whilst other rollers, fixed on the top of the tank curb, pressed against the outside of the outer holder.

When the inner and outer lift of a telescopic holder were both counterbalanced, there was sometimes a slight danger that the outer lift, through excessive friction, might be hung up, whilst the inner lift descended—an escape of gas following. In order to obviate this risk, the late Mr. Thomas Piggott patented* a cleverly-arranged self-acting bolt or lock, by which, when the inner holder cupped, it became rigidly fastened to the outer holder as soon as this began to rise. In descending, these bolts were only set free, and the two lifts allowed to separate, when the outer holder touched the rest-stones.

Gradually, with the advent of better workmanship and more accurate machinery, the established practice in fixing gasholder guide-rollers appears to have been to arrange them so that all, with the exception of those attached to the under side of the cup, should work in the channel guides of the tank or standards. Special attention was given to the following points: (1) The face and rim of the roller to be accurately turned; the former being made slightly convex. (2) The pin to fit evenly, but with freedom, in the boss. (3) The carriages to be so constructed that the rollers might receive their final adjustment after the holder was filled with gas. (4) The rollers to be radial with the centre of the holder. (5) The guides to be perfectly plumb, and exactly equidistant from centre of tank.

Returning again to a consideration of the development of the bell of the gasholder, and tracing its various modifications from the time of Malam and Clegg, we notice, in the first place, that the shell has always been made of plain wrought-iron sheets; the overlapping edges being fastened together by rivets. Steel plates, for certain parts of the shell, were not introduced till quite recently. A suggestion was made by Morton, in 1855,† to use corrugated sheets, galvanized or otherwise; but it is doubtful if it was ever taken up. From time to time various modifications in the shaping or jointing of the sheets have been patented. For instance, one inventor proposed to cut the sheets to the shape of the letter L in plan; another suggested soldering the joints; while a third considered they would be better made, and far more gas-tight, if the edges were simply turned over and beaten down.

Whilst, however, no deviation was made in the material of which the shell was composed, very great differences may be observed in the constructive details of the bell. But here a difficulty creeps in, on account of the impossibility of assigning a definite date to any particular modification or improvement. For instance, some of the earliest gasholders were practically untrussed; whilst others had trussing composed of main bars, secondary bars, centre column, &c., as in many of the holders of to-day. At a very early date, a controversy began as to whether the roof of the holder should be trussed or untrussed—a controversy which can hardly be said to have died out even at the present time.

As a rule, the trussing was fashioned much after the style of the beams and rafters of an ordinary wooden roof; though occasionally a somewhat different arrangement was tried. For instance, in a holder the sides of which were strengthened by rings of T-iron placed one above the other, about 5 feet apart, whilst the roof was supported by stays of wrought-iron tubing stretching from the crown sheets to the bottom row of T-iron rings. The centre portions of the roof were further strengthened by concentric rings of flat iron. The trussing was always placed inside the bell; although William Malam proposed‡ in 1854 to place it outside. Generally, the roofs were domed; the superior strength of the domed form being early recognized. In the earlier holders, the sheeting was always riveted to the main and secondary bars and laths of the trussing; but later on this practice was abandoned—to be again revived by Mr. V. Wyatt about the year 1874.

Occasionally the designer appears to have had a somewhat hazy idea of the purpose served by the trussing, as we find an untrussed gasholder collapsing in the year 1848, because, "whilst the trussing had been abandoned, no extra strength had been given to the outer angle at the top, which clearly was an oversight." And as clearly an exception; for in another holder built about the same time, and also practically flat topped—rising only 2 feet in 142 feet diameter—it was distinctly specified that the roof was to be untrussed, and "the top curb to be a circular chamber or girder, in section nearly rectangular," built of stout angle-irons and thick plates.

In the year 1850, Palmer and Horton took out letters patent§ for an improved form of crown curb to be used in flat-topped holders. They proposed to use two rings, the outer of single, and the inner of double angle-iron, with a strong plate between, in conjunction with what they called "equilibrium blocks" of greenheart or other hard wood, which were to be fixed between the two rings. They recognized the inconvenience of rain collecting on the roof when the holder landed; and this they provided against by means of an ingenious hydraulic cup-valve, placed in the centre, which allowed the rain, as it accumulated, to pass through into the interior of the holder, and so increase the contents of the tank.

When dealing with flat-topped holders, mention must be made of the professional duel which took place between Mr. George

* Patent No. 641. † "The Guide-Framing of Gasholders."
‡ Patent No. 4832. § See JOURNAL, Vol. LIX., p. 628 *et seq.*

* Patent No. 1134 of 1855. † Patent No. 643.
‡ Patent No. 242, § Patent No. 12,974.

Anderson and the late Mr. T. Hawksley at the meeting of the British Association of Gas Managers in 1868, when the former gentleman entered into a vigorous defence of flat-topped untrussed holders. Mr. Anderson maintained that this form of holder possessed greater durability, and was subject to less wear and tear, owing to the lower position occupied by the centre of gravity. For the same reason, he contended that it had less liability to tilt; effected an economy in material; and required much lighter standards. The ensuing discussion was practically carried on between the writer of the paper and Mr. Hawksley; the latter maintaining that the "strength of a properly trussed crown was usually double, with the same thickness of metal, that of a flat-framed gasholder." He strongly condemned untrussed holders, especially those with flat tops, and recommended that the crowns should be made with a rise of 1-20th of the diameter.

In his paper, Mr. Anderson made frequent reference to the design of untrussed holder with flat roof favoured by Mr. Croll, then Engineer to the Great Central Gas Company (subsequently amalgamated with The Gaslight and Coke Company), four of which were built, contiguous to one another, at the same time, at the Bow Common works. They are described in full detail in Vol. II of "King's Treatise." These holders were erected in 1848; and in 1874 Mr. V. Wyatt, in referring to them, said "he had often been surprised at their weakness. They were most fragile structures; and but that they were clustered together, and were after all comparatively small, he thought that the whole of them would have blown away. They were so flexible that almost any movement of the foot or body would distort them in shape. It was impossible to apply the principle upon which they were constructed to holders of a million feet capacity." This is not the place to discuss whether this principle was a right or a wrong one. It is, however, interesting to note that, in spite of the adverse criticism quoted above, these "most fragile structures" have stood the test of time excellently well, and are still doing yeoman service. The Resident Engineer of the Bow Common works (Mr. J. Wilton) states, in a memorandum received by the writer whilst preparing these pages, in reference to the above holders, that "in 1886 the greater portion of the sides were replated, and the holders are now working very satisfactorily."

The sides of the gasholders built between the years 1830 and 1870, were, as a rule, strengthened by vertical stays of various descriptions; timber balks, box or lattice girders of simple design, and trussed T-irons, channel, or angle irons being indifferently used. These were sometimes attached to the sheeting from top to bottom, or at a few points only; their upper ends being secured to the crown curb, and their lower ends to the bottom curb. This latter was formed of angles and strong plates placed outside, to which the bottom guide-rollers were attached. As early as 1850, Palmer and Horton suggested (in the specification before referred to) that the vertical ribs should not be attached to the side sheets at all, so that they might throw all the weight of the roof on to the bottom curb.

When Vol. II. of "King's Treatise" was published (in 1879) the Editors remarked, when dealing with telescopic holders with three lifts, "We shall now proceed to give some details, with illustrations, of three-lift holders, of which there are but very few in existence." They then illustrate and describe three triple-lift holders; the first being erected at Rotherhithe in 1852. This holder never gave satisfaction, as each lift was only 12½ feet deep, and more than 100 feet in diameter. A new departture, however, was made in the construction of the top curb, which, in order to obtain the desired pressure, was made of cast iron, and measured 18 inches by 9 inches, bolted together in 10-feet lengths. Perhaps this is the only instance in which cast iron has been so employed. The second triple-lift holder was also erected in London, in 1861; and the third in 1876, at the Hove works of the Brighton Gas Company. It is not necessary to describe any of these holders; but we must note in passing that, in each of the above examples, a three-lift holder was adopted owing to the exigencies of the situation—the sites being such as precluded the building of a deep tank, owing to the nature of the ground, or a tank of large area, on account of the very close proximity of contiguous buildings. It is extremely doubtful if the designers would have adopted this style of holder had their hands been free; as, about this period, three-lifts were not regarded as economical, or to be admired except as pieces of excellent engineering. The reception thus given to the triple-lift holder affords a remarkable contrast to that accorded to the double-lift, which was hailed with delight by the profession at large, but deprecated by the general public.

One objection raised against holders of more than two lifts was the liability of the water in the lutes to freeze, and the consequent danger to the structure. It may not be out of place to notice here several suggestions which have been made for overcoming this difficulty, and which certainly possessed the charm of novelty, though chronologically they belong to a later period.

The first is a scheme for causing hot water to circulate round the tank and lutes, proposed by Key in 1879,* which would have been feasible enough had not the inventor also relied upon it for imparting "heat to the sides of the holder, and this heat radiating into the interior of the holder raises the temperature of the gas within above that of the outer atmosphere, thus retaining the hydrocarbons in the gaseous or vaporous state." Evidently the cost of fuel had not been thoroughly considered.

This scheme, however, was far surpassed in novelty by that of Fleming,* who suggested (so late as 1881) that holders should be built with double sides and crowns; and into the space between, provided with suitable baffle-plates, he would have forced the waste gases from the retort-furnaces by means of a blower or fan. Should this arrangement have been considered objectionable, he would have provided the holder with a "top coat" of some material impervious to water and heat—using, among other materials, "wood-ashes, loams, soils, or sands." Another inventor† in the same year specified "a certain chemical substance," which was to be added to the water in the tanks or lutes, and so form a solution whose freezing-point should be low. It is, however, but fair to note that the three foregoing inventions received provisional protection only.

Practically the only method used in England to keep the lutes free from ice—the tanks being left to take care of themselves—is to inject steam by means of a metal pipe ¾ inch or 1 inch in diameter; the end of the pipe dipping an inch or two beneath the surface of the water in the lutes. The steam is supplied at a pressure of about 40 lbs.; and the pipe enters the water at an angle of about 15°. By this arrangement a continuous circulation is kept up, and the water in the lutes can easily be maintained at a temperature 2° or 3° above freezing-point. As the holder rises or falls, the steam-supply pipe (of flexible hose) is paid out or taken in, as in Cutler's anti-freezing apparatus, patented in 1888.‡ A still later method for attaining the same end is that suggested by Mr. George Livesey in 1892,§ in which he proposes to use a number of Bunsen or other flames, fixed at intervals around the cup or lute, and so arranged that they impart their heat to the water beneath its surface, and thus keep up a gentle circulation.

(*To be continued.*)

* Patent No. 5142.

* Patent No. 3877. † Patent No. 5299.
‡ Patent No. 454. § Patent No. 1909.

TECHNICAL RECORD.

INFORMAL MEETING OF SCOTTISH GAS MANAGERS.

The Eleventh Annual "Informal" Meeting of Scottish Gas Managers was held in the North British Station Hotel, Glasgow, on Wednesday last, under the presidency of Mr. T. Wilson, Manager of the Coatbridge Gas Company's undertaking. The popularity of the "Informal" meeting seems to be growing, for every year the attendance is larger than at the preceding gathering. On the present occasion, about sixty gentlemen assembled.

Visit to the Dawsholm and Temple Farm Gas-Works.

The company met at the Hotel at one o'clock, and took train for Maryhill, beside which is the Dawsholm gas-works of the Glasgow Corporation. Entering the works by a side entrance, they were received by Mr. William Foulis, the Engineer to the Glasgow Gas Commissioners. Mr. A. Wilson, the Manager of the station, was present; and he showed the visitors over the establishment. Unfortunately, the weather, which up till then had been quite on a level with the exceptionally fine experience of the past few weeks, broke down; and the first portion of the visit was spent amid the discomfort of a drenching thunder-shower. Since the visit a year ago, when the point of attraction was the huge 6 million cubic feet gasholder—then under construction, but now completed and working to the utmost satisfaction—various other additions to the works have been completed, and are in use. Over these the visitors were shown. The first to be inspected was the station-meter house, in which are two large meters, by Messrs. R. Laidlaw and Sons, capable of measuring 120,000 cubic feet of gas per hour each, with room for two others when they are required. The party then passed to the purifier-house, in which there are three sets of purifiers, each 30 ft. by 25 ft. by 5 ft. deep, working with two tiers of trays, but capable of being worked with four. Space is reserved between the purifier and exhauster houses, which were next visited, for two more sets of purifiers. In the exhauster-house are two of Messrs. R. Laidlaw and Sons' exhausters, worked by vertical high-pressure steam-engines; and there is room for two others, when required. Crossing the yard, where one of the puny locomotive engines, which are used to fetch the waggons of hot coke from the producer-floor of the retort-house, was careering about, the party entered the new retort-house. This is a spacious building 350 feet in length by 78 feet in width, with a lofty roof of iron and slate. Along its centre runs an immense stack of ovens, containing 512 retorts, in settings of eights; each retort being 9 feet long by 21 inches broad and 15 inches high, and capable of carbonizing one ton of coal per 24 hours. Here the Arrol-Foulis charging and drawing machinery was in operation; and general satisfaction was expressed at the expeditious and cleanly manner in which it does its duty. For the working of the house, four charging and four drawing machines are required; the operation of charging and drawing eight retorts being from six to seven minutes. At the end of

the retort-house is a coal-store 150 feet in length and 78 feet in width. The coal is brought into the store by rail at a level of 17 feet above the floor. Men discharge the contents of the waggons into broad wooden shoots, which lead down to the coal-breakers; and elevators raise the broken coal to the hoppers at the end of the retort-bench. At each side of the house, there is a fixed hopper capable of holding about 20 tons of coal; and from these the hoppers on the charging-machines are filled. These are capable of holding 5 tons of coal, or sufficient to charge 40 retorts. At one side of the retort-house is a conveyor, which carries the broken coal half way along the house, and deposits it upon an elevator; this arrangement obviating the necessity for bringing the charging-machines which serve the end farthest from the coal-store along the entire length of the house when their hoppers require replenishing. From the new retort-house the company walked into the old one, which is similar in size, and which at present is being reconstructed so as to enable the same machinery to be employed in it which has been placed in the new house. The total capacity of the station is at present 13 million cubic feet per day; and there is space for the erection of another retort-house, after which the output will be 18 million cubic feet. Having finished with the Dawsholm works, the party proceeded across the canal to the Temple Farm works, acquired by the Corporation from the Partick, Hillhead, and Maryhill Gas Company. These works are being gradually closed by the Corporation as a manufacturing station; the intention at present being to ultimately utilize the space chiefly for storeage purposes. Already the 6 million cubic feet gasholder has been constructed within it. But the works had, on this occasion, an interest beyond what they had last year (when the Company inspected the new holder), in the experimental water-gas plant which has been fitted up within them. This is capable of producing 350,000 cubic feet of gas per day, blowing four and running seven minutes. It is on the improved Lowe principle; and its construction and working were described by Mr. A. G. Glasgow, of Messrs. Humphreys and Glasgow, of London. For his kindness in showing them the plant at work, the company, before leaving, accorded Mr. Glasgow a hearty vote of thanks at the suggestion of the President. About a quarter of a mile off was the Great Western Road Station; and thither the party proceeded in time to catch a train for Glasgow about three o'clock. On returning to the city, the meeting was constituted by Mr. Wilson taking the chair.

The Meeting.

Mr. J. M'Gilchrist (Dumbarton), the permanent Convener of these meetings, having offered a few words of welcome to the company,

The Chairman proceeded to deliver the following address:—

Mr. M'Gilchrist and Gentlemen,—Allow me to thank you for placing me in the chair to-day, and to say how pleased I am to see so many of you present. Before beginning the business of the meeting, I should like to say a word or two regarding the loss the gas industry has sustained through the death of Mr. John Allan, proprietor of the *Gas World*, which took place last Friday morning. Mr. Allan was a prominent figure, and took an active interest in all our meetings; and I am sure I speak the mind of all present when I say we are deeply grieved at his death, and we extend our kindliest sympathy to Mrs. Allan and her family on their bereavement. I should like, with the approval of this meeting, that a letter of condolence should be sent to her.

The winter just finished has not passed without giving trouble and anxiety to gas companies and their officials. Though the demand for gas has not been so great as might have been looked for, owing to the mildness of the weather and depression in trade, yet the troubles came from another quarter. First there was the miners' strike in England, which lasted a number of weeks—paralyzing trade, and costing gas companies and corporations large sums of money for coal—it having to be procured from Scotland and elsewhere. No sooner was this trouble finished than our Scottish miners came out; and though this strike did not last so long, it was the means of causing considerable anxiety to gas managers, especially to those who had small stocks of coal. The experience of the past winter shows the necessity of always keeping a good stock on hand.

The carbonizing of coal is a very important part indeed of the manufacture of gas; and I think this department has not received the attention it deserves. Though many improvements have been made in the form of retorts and in their settings, as well as in the form and plans of heating, yet the principle of carbonizing is much the same as it was in the days of Murdoch. I was very much struck with a paper read by Mr. D. M. Nelson at the meeting of the North British Association held at Dundee last July, on the results obtained from the working of the Yeadon retort.* It is a well-known fact, that, by keeping the coal in motion while it is being distilled, a large increase in the volume of gas is obtained, while the quality does not suffer to any material extent; the increase being due to the conversion of part of the fixed carbon which remains in the coke under ordinary distillation, and by a proportion of the tars being converted into permanent gas. The Yeadon retort is, in my opinion, a step in advance of anything that has yet been discovered; and if these retorts can be made to stand the work, I am sure that it only requires a little time and experience to show that the principle is really what is wanted. I observe that Mr. Nelson is with us again to-day; and I shall expect him to give some further information regarding the process.

We have just had the pleasure of inspecting the water-gas plant at the Dawsholm works. While this system has been largely adopted in America, it has not hitherto been very favourably considered in Scotland—difficulty being experienced in the enrichment; but now that so many valuable processes of enriching by oil have been discovered, there need be no further obstacle to prevent its adoption. It is only a question of pounds, shillings, and pence. I do not know what you thought of it; but I considered it was a very complete arrangement, and a very workable one. Of course, it is not applicable to small works; but to large ones it is a very great advantage. A considerable amount of attention has lately been given to the various oil processes, and deservedly so, as they are all of great value, especially to those gas companies who have the misfortune to be placed at some distance from the coal-fields.

At our last meeting, Mr. A. Bell, jun., gave us particulars of the working of the Peebles process;* and since then a number of gas companies and corporations have adopted it with good results. I see among us one or two gentlemen who should be in a position to afford some information regarding the results, seeing that they have had a winter's practical working on a large scale. There are other processes, all of which have something to be said in their favour; but it would appear that, in Scotland at least, the Peebles process is preferred. It is simple, and easily wrought; and it is not costly. Some of you will, no doubt, wonder how it is that it has not been more generally adopted. But to some companies who are favourably situated, being near the coal-fields, the advantage, if any, would not be so great as to warrant them in so doing. Besides, were its adoption to be universal, the oil would have a tendency to rise in price; while, on the other hand, coal would fall.

The uses of gas for cooking, heating, and motive power are largely on the increase; and a new class of consumers has been reached by the introduction of the prepayment meter. In some towns, the houses of the working and poorer classes are all fitted for gas; but where the deposit system exists, a large number will not use it. Since the introduction of these meters, however, a large increase in the number of consumers has resulted. A number of gas companies have adopted them, with satisfaction to both the consumers and themselves.

We are threatened on all sides with opposition from electricity—a splendid light, but an expensive one. In my opinion, gas companies have nothing to fear from this source. With the improvements effected in the appliances of our works, together with the increased uses of gas, it is certain to hold its own against all comers.

I have purposely avoided adducing figures as to oil enriching as compared with shale enriching; but there are gentlemen present who, I am sure, will be able to do this better than I can. Then with regard to water gas, my friend Mr. Wilson, of Dawsholm, is in a position to give us the cost of it. I may tell you that the Directors of the Company I represent were very anxious that the subject of oil gas should be investigated; and I made inquiries, and furnished them with a report. If it was desired, I dare say I might read it here; but I think it would possibly be better to hear the figures of others who have been working the process.

I thank you, gentlemen, for the patient hearing you have given me; and I trust these few remarks will be the means of creating profitable discussion.

Mr. M'Gilchrist thought that, if the Chairman were to read his report, it might assist them in discussing the subject.

This suggestion having met with approval,

The Chairman read the following report:—

Green Oil.

Sp. gr. ·885; cost per ton 50s.; add royalty, 2s. 6d. .	52s. 6d.
Deduct value of coke	5 0
Total	47s. 6d.

Gas produced, 22,865 cubic feet per ton; quality, 90 candles; cost per 1000 cubic feet, 2s. 0·92d.; cost per candle per 1000 cubic feet, 0·27d.

These are the results of practical working. There is a cheaper oil, which has been used on an experimental scale, and I am not sure but also on a practical scale. This is—

Blast-Furnace Oil.

Sp. gr. ·996; cost per ton, 26s.; add royalty, 2s. 6d. .	28s. 6d.
Deduct value of coke	8 0
Total	20s. 6d.

Gas produced, 21,945 cubic feet per ton; quality, 60 candles; cost per 1000 cubic feet, 11·20d.; cost per candle per 1000 cubic feet, 0·18d.

These are the two oils. In Coatbridge we are very favourably situated, being near the coal-fields.

Shale.

Cost per ton, 10s.; deduct amount received for residuals, 3s. . . .	7s.

Gas produced, 9500 cubic feet per ton; quality, 36 candles; cost per 1000 cubic feet, 8·84d.; cost per candle per 1000 cubic feet, 0·24d.

The advantage is not in using oil; the advantage would be in employing a cheaper class of coal along with the oil. I have gone into that

* See Journal, Vol. LXII., p. 310.

* See Journal, Vol. LXI., p. 687; and Vol. LXII., p. 264.

too; and I find that the most profitable coal would be a coking coal, or triping.

Coal.

Cost per ton, 7s. 6d.; deduct amount received for residuals, 3s. 6d. . . 4s.
Gas produced, 8000 cubic feet per ton; quality, 16 candles; cost per 1000 cubic feet, 6d.; cost per candle per 1000 cubic feet, 0·37d.

Coal and Oil.

Taking five of coal and one of green oil, would give a gas of 26·4 candles, at a cost of 9·15d. per 1000 cubic feet.

Taking four of coal and two of blast-furnace oil would give a gas of 30·4 candles, at a cost of 7·73d. per 1000 cubic feet.

At Coatbridge, I may tell you, the gas has cost us during the last six months 8·18d. per 1000 cubic feet of 25·32-candle gas. Now, there is ground for discussion. I might just remind you that we are in the centre of the Scotch mineral field, and our materials are very cheap. If you were far removed from the field, and had to pay (say) 12s per ton for coal, the situation would be altered. I am speaking of the Peebles oil process, as I have not taken up any other.

Discussion.

Mr. ADAM (Airdrie) asked if the statement the Chairman had submitted to them was for material only.

The CHAIRMAN replied that it was.

Mr. ADAM thought it was not a very exhaustive view to put forward, because the flowing in of oil by gravity was cheaper to work than the handling of shale.

The CHAIRMAN said the information he had obtained was from gentlemen who had worked the process practically; and neither of them had said they saved anything in labour. There was no doubt there was a saving of labour; but that, again, would be met by the extra expense in retorts. He did not touch upon this, because he allowed the one to go against the other. It was quite evident that, in using blast-furnace oil, the expense of keeping up the retorts would be great, because of the high temperature required to break up the hydrocarbons.

Mr. M'GILCHRIST suggested that, to assist in the discussion, they might take up *seriatim* the matters introduced by the Chairman, who had given them nine subjects. Coal strikes was a very important thing for them to consider. He thought it must appeal to every gas manager that it would not do to depend upon the collieries for a supply of coal during the winter season. They all knew that the miners took advantage of short stocks at gas and other public works, and, at the most troublesome time, brought about a strike. He was glad to see that, at their Dawsholm works, the Glasgow Corporation were taking time by the forelock, and were laying in an immense stock of coal. This was in the right direction; and he thought gas companies and corporations should profit by what they had that day seen, and have in a large stock of coal at a time of the year when they could get them, and not have, as he was sorry to say most of them had, to be getting their supply from hand to mouth in the winter season. Probably if they were to discuss the coal strike first, they could go into the question of the Yeadon retort, water gas, cooking by gas, payment by "slot" meters, electric light, and last, but not least, that wonderful report which the Chairman had made to his Directors.

The CHAIRMAN asked if Parliament was not going to settle the subject of coal strikes. He thought the meeting could not settle it; but they could arrange to have better stocks.

Mr. M'GILCHRIST said this was a policy which gas managers might adopt; because strikes were becoming very frequent.

The CHAIRMAN said it was to the interest of gas companies and corporations to have a good stock of coal, not alone on account of strikes, but on account of the coal getting dry. He found that, when they had coal in stock for four or five months, they obtained better gas from it. The carbonic acid was out of it. He thought they should hear what Mr. Nelson had to say of the Yeadon retort.

Mr. D. M. NELSON (Glasgow) said the coal strike was the cause of his not being able to give them the information he would like. During the past twelve months, many had been in great straits as to coal; and in places where the Yeadon retort had been established, the managers had been so interested and so concerned about their coal supplies, that the Yeadon retort had not had that share of attention from them which it deserved. He might tell them that, since he said something on this subject at Dundee, they had overcome many difficulties in the process—more especially mechanical difficulties, which were the most trying to them. The heating of coal at different temperatures was always a most difficult thing. It was also difficult to keep a retort tight enough by any system of expansion joints. They were told by Mr. Terrace, of Middlesbrough, that if they could get over the mechanical difficulty of keeping the joints tight, the process was perfect in itself. The Chairman had told them that day that he believed in the principle; and he (Mr. Nelson) could tell them that he believed in more than the principle of working off the coal and driving off the gas as quickly as possible, so as not to let the coal remain in the retort to be "stewed," as in the ordinary method. The fact that they had gas delivered in 15 minutes, and that the cinder was incombustible, showed that they were getting all that was volatile from the coal. They could put the cinder in the fire; and it would hardly burn—showing that they had taken out of the coal all the gaseous vapours, naphthas, benzols, and other volatile matters that made gas illuminating. The very fact that they had pitch, instead of tar, was evidence that they had made the tar into gas. What they had not in the cinder, and what they had not in the ammoniacal liquor, they had in the gas, in increased quantity and increased illuminating power. At Ripon, any difficulties there had been in relation to the production of gas by the Yeadon retort, had arisen in the management of it. In principle, it was absolutely perfect—as perfect as any mechanical operation could be, he thought, and any drawbacks or difficulties they had had, had been owing to the desire that all inventors had, of trying to do something better, by altering it. He found that, at Leeds, the results were so satisfactory that they had no hesitation at all in going on. He might say that they had overcome all the mechanical difficulties. Anything which had been wrong had been mistakes on the part of those who did not know how to distil the coal into gas. These, of course, were being lived down; and the fact that they had something like £5000 of orders for these retorts, and other orders "hanging fire" because they wanted to have some substantial results before going on with them, was evidence that many gas managers believed in the system. They realized excellent results the previous week, under trying circumstances, he might say. He was at Leeds for four days and four nights; and the results were such as to satisfy him that the process was certainly a step a long way ahead in the production of gas from coal. He might say that they made a trial of the distillation of waste shale, sent from Young's Paraffin Light and Mineral Oil Company. They distilled the shale, which was worthless for ordinary distillation, and lying as a waste (there were, he supposed, millions of tons of it lying all over the country); and they obtained from material costing 1s. per ton, 12s. 6d. of commercial value. Regarding the test for enrichment, there was this to be said, that they could have two processes—they could distil at a low temperature and have oil, or they could distil at a high temperature and have gas. They simply fed the material from above by a conveyor, as they had at Ripon; and the charge went down into the retort, the retort revolved, and being shaped narrow at one end and wide at the other, the material travelled to the wide end, was discharged by a worm, and was pushed into a truck and taken away.

Mr. M'GILCHRIST said there was one very important point which Mr. Nelson had omitted; and that was the cost of the gas per 1000 cubic feet. If he could give this information, it would be worth a great deal, especially if it was found to be cheaper than any of the other processes referred to.

Mr. NELSON said that a year ago he stated that the test made at Leeds gave 6¼d. per 1000 cubic feet of gas from the retort into the holder. The illuminating power was something like 22 candles. This, of course, was with English coal. He might say that their experience with the retort was that, the higher the quality of the coal, the higher the yield—both as to quantity and quality of gas.

The CHAIRMAN: Is that the total cost or the cost of the material alone?

Mr. NELSON: The total cost.

The CHAIRMAN: Can you not give the meeting some idea of the figures as to the volume of gas produced in the Yeadon retort, compared with the ordinary system of carbonizing?

Mr. NELSON said that if the ordinary production was 10,000 cubic feet per ton, they produced 12,500 cubic feet in the Yeadon retort; and if the ordinary illuminating power was (as in England) 16 candles, they had from 20 to 22 candles. The previous week they passed coal through the retort at the rate of 8 tons in 24 hours. They were only bound to put through 7 tons, but they passed 8 tons. They found that, by passing the coal more rapidly, they had a better result than when passing it slowly—curious as it might appear. This showed that the gas suffered very materially by lingering in the retort; the sooner they rid the retort of it the better. Of course, the process was still only in an experimental stage; and they were anxious, seeing there were so many processes in the market, that they should be certain of what they attained. The retort took the place of 15 ordinary retorts. When they worked it in combination with ordinary kinds of retorts, they found that the illuminating power of the gas travelled up from 16 to 23½ candles; showing that the gas was really profiting by the union with the Yeadon gas. Then when they stopped the Yeadon, the quality fell back—just what they would naturally expect.

Mr. J. B. TERRACE (Brechin): Are you much troubled with carbon?

Mr. NELSON replied that, during those four days and nights, there was not a trace of carbon; but he might tell them that had been a difficulty, because the inventor unfortunately, made a contraction in the retort, which he thought would be of service. They had now discarded it, as it kept the charge longer in the retort. The inventor was troubled with chokes; but he (Mr. Nelson) found during those four days there was not a spoonful of carbon. If this could be done during four days and nights, by being careful, there was no reason why it should not be done for four months.

Mr. D. ROBERTSON (Dunoon): Might I ask Mr. Nelson what kind of fuel he is used in heating?

Mr. NELSON: We use the coke made at the Leeds Corporation Gas-Works. At Ripon, we used the coke produced at the gas-works.

Mr. ROBERTSON: Not the coke made in the Yeadon retort?

Mr. NELSON: Oh; we cannot use that.

Mr. ROBERTSON: There is the cost of the coke you use taken into account?

Mr. NELSON: Yes; and we have also taken into account that we have a very valuable cement from the cinder—worth about 1s. per cwt.

Mr. R. MITCHELL (Edinburgh) thought the percentage of ash must be very small, and that it would take a very great number of tons of coal to make up a hundredweight. But more marvellous was Mr. Nelson's claim that there was 25 per cent. greater yield of gas, and close upon 30 per cent. greater yield of illuminating power. If these figures were correct, he (Mr. Mitchell) could only, along with the Chairman, advise all interested in the gas industry to give the process their most serious consideration—it was really a marvel to him.

Mr. J. DONALDSON (Cambuslang) asked Mr. Nelson where he obtained the "hydrogen to combine with the carbon in the retort to form gas."

Mr. NELSON said the process was the ordinary one of the distillation of gas from coal; and he had no doubt there was a large amount of hydrogen passing into the retort with the coal. In that way he had no doubt they had, in the distillation of the naphthas and benzols, matters turning into gases. They must necessarily have air drawn into the retort, which formed gases that would otherwise be drawn off as liquids. The air went with these oils and formed a vapour of gas; and it came off as permanent gas. He was strengthened in his view by this, that they made 50,000 cubic feet of gas before the Christmas of 1892, which they left for three weeks in a holder by itself; and it was found at the end of the time that there was actually more gas in the holder than when it was put in, and there was also a perceptible increase of illuminating power. There was no trace of anything whatever in the syphons—no liquid of any kind; showing that it was an absolutely permanent gas, and overcoming one of the difficulties they had always had with oil gas. He had to do with oil gas at one time many years ago; and it was a difficulty with that gas, as far as he could understand it, that they always had it in a form that condensed. He believed, however, in justice to the Young and Bell oil gas, that they had overcome, in a great measure, this trouble of condensation; but he knew that the Pintsch oil gas of some years ago, and other oil gases, gave trouble in condensation.

Mr. H. POOLEY (Dunfermline): Did you say, Mr. Nelson, that the gas improved by keeping?

Mr. NELSON: In this case it showed a perceptibly greater bulk, and a perceptibly higher illuminating power; and it could get no assistance from any other gas, because there was no connection. The only thing, I may say, which would account for it is possibly that at the time we filled the 50,000 cubic feet holder it was colder weather, and that the heat of the sun may have raised the temperature and increased the bulk of gas. I have seen a gasholder rise half a sheet while I was looking at it. The illuminating power was perhaps a half-candle more; it was certainly no less. What I want to say is that this gas does not lose in illuminating power.

Mr. A. MACPHERSON (Kirkcaldy) thought this then was really a "new carburetting process." It was certainly something new to him. He always understood that the Yeadon was an air-tight retort. He would like to know what effect the temperature inside the retort had on the ammonia. There was also another matter which, like Mr. Pooley, he could not solve at all; and that was that they should have an increased volume of gas, and an increasing illuminating power. To him, the thing was quite preposterous.

Mr. NELSON: Aye; from your point of view.

Mr. MACPHERSON: And from a scientific point of view too. It is the old thing that Mr. Nelson got rapped over the fingers for before. The Malam process increased the volume and the illuminating power. But I think Mr. Nelson found it to be not true, to his cost; and Mr. Nelson may rest assured that the statement he has made here is an improbable one. We all know that it is an impossibility that gas should improve in quantity and in illuminating power; and he need not come and make such a statement, thinking it is a correct one, because I think I will get the support of everyone here that it is a moral impossibility. We all know very well that, when the sun is striking a gasholder, it may rise half a sheet, or two sheets; but Mr. Nelson must remember that, if he is testing the gas aright, he corrects the temperature and pressure, and that by no possibility could the gas once stored in the holder, unless by artificial means, increase in bulk.

Mr. NELSON: I only wanted to say this, that so much has been made of those scientific modes of making gas, that if they are all right in one way they are all wrong in another. I daresay Mr. MacPherson has known me long enough to be sure that I, like him, can understand that gas, as made, goes into a gasholder in waves. Of course, we were not dealing with the gas upon exact, scientific, indisputable data; we were doing it by a short method, in an apparatus that was not well adapted for the purpose. Admittedly so. But we took the measurement of the holder and tested the gas then, and left it, after the gas had been newly made; and I have yet to learn that gas may not improve after that particular testing by being left to circulate and mix. I think you will always find that in the beginning and end of a charge you have not the same quantity and quality of gas going into the holder; and if you were to test the gas of a 5-hour charge at 2½ hours, there would be a very different quality at 4 hours or 1½ hours. I only wish to say that there was no appreciable diminution of the volume or illuminating power; but to put me down as saying that there was an increase is really beyond what I said.

Mr. MACPHERSON: With Mr. Nelson's latter remarks I cannot at all agree. He surely has not heard of the law of diffusion of gases, which we all know is very rapid in its operation. I did not understand Mr. Nelson to say that he tested either the beginning or the end of a charge, but the full charge, and if he put the full charge into the gasholder, then by the law of diffusion, his gas had come to a uniform standard before he tested it.

Mr. T. D. HALL (Montrose) thought they all knew pretty well what Mr. Nelson meant. What he considered that that gentleman, in his zeal, wished to impress upon them was that the gas diminished neither in volume nor illuminating power; and he thought Mr. Nelson should be content with this statement.

The CHAIRMAN said they were all very much indebted to Mr. Nelson for the description he had given them of the Yeadon process. He was sorry that the process was still on an experimental scale, and that Mr. Nelson was not at liberty to give them the figures he should like; but he thought they might take it that there had been no increase in the quantity or quality of the gas, because Mr. Nelson explained that the temperature was not taken, and that the sun was shining on the second occasion.

A vote of thanks having been accorded to Mr. Nelson for his description,

The CHAIRMAN said they would now be very pleased to hear Mr. Glasgow give a description of the Lowe water-gas process.

Mr. GLASGOW said that, so far as their process was concerned, it was not sufficient to make a comparison of the material; they must take their gas into the holder. For instance, suppose they were comparing the cost of manufacturing the same candle power gas—say, 30-candle—with such methods as prevailed in Glasgow, he should say they would measure the unpurified gas, and would find that it would cost a certain amount, and as far as coal gas was concerned it would do so. Now, the question of purification was a small matter. They had had some idea that day of an experimental small apparatus working a large volume of water gas. The plant was of such a character that it might be let down and re-started, either once or an indefinite number of times, without causing the least damage to it on this account. The question as to the labour required, which was outside the question of materials, could be shown by their plant at Belfast. In the previous week, he found that Mr. Stelfox had there, in a building measuring 31 ft. by 60 ft., a carburetted water-gas plant making 17 million cubic feet of gas daily. All the carburetters and the coke elevator and other impedimenta were placed in that building; the only thing outside being the boiler and the blower. The output at this time was 40 per cent. of the output of Belfast. One man operated the plant, as far as the gas machine was concerned, and one man ran the boiler and oiled the engine. Once in 12 hours, a gang of about eight men, coming from the yard, worked for about 20 minutes cleaning the machine. The other labour was in conveying the coke to the hoist which lifted it up. It would require a man to do this properly; and that was the sum-total of the output up to the purifiers. They were not long in seeing that they must take into consideration something more than the expense of material. He was not in a position to say anything about the cost of oil and water gas combined. He supposed he must leave this to the managers of works.

Mr. MACPHERSON asked if Mr. Glasgow would inform them if there was any danger of the oil not working properly, and the water gas passing to the holder without being carburetted.

Mr. GLASGOW replied that it would not do to say it was not possible. For instance, if the oil did not get into the apparatus, the gas would be non-illuminating. But if the man were sober (laughter), he would see that the gas at the test-burner was burning with a blue flame; and this was a thing which would not continue, for the gas was only run for seven minutes.

Mr. A. WILSON (Dawsholm, Glasgow) said that he was sorry he was in the same position as Mr. Nelson. They were still experimenting, and did not care about giving figures as to the working of the water-gas plant. The machine was unquestionably a good one for making gas. There was no difficulty about it; and there seemed to be no danger of making mistakes such as Mr. MacPherson spoke of. They had a test-light burning at a place where the man in charge could see it; and this approximately showed the quality of the gas. If no oil were going in, he might not notice it at once; but he would soon see that something was wrong, because the oil was measured in, and his meter would show him if none were flowing. The oil they had been chiefly using, was the ordinary shale oil; but of late they had been working with different oils. He did not consider it right to make the figures public before he gave them to his employers, so long as the thing was only on trial. It was an experiment to find out the value of water gas under local conditions. The financial aspect of the working, of course, appealed most to them; but water gas in large works had many other things to recommend it than pounds, shillings, and pence. In a place like Glasgow, where they were troubled very much with fogs, they could get up a water-gas plant in about three hours, whereas, with ordinary retorts it would be about 48 hours before they could get them into working order. There seemed to be

no difficulty about getting up the heat. They had had it up and down he did not know how often, just to try its power to stand the test; and, so far, it had given them every satisfaction. He had occasion to look inside the plant on the previous morning; and it was just as good as when it was first put up. Another consideration with them was that they used coke—not a considerable quantity, certainly. But he had known times when coke was not worth very much—it was rather a trouble than anything else—and he thought they could put a stop to the trouble. He considered that it was advisable, in ordinary times, to have an outlet for their coke if they wanted it. He had no difficulty in teaching the men the working of the apparatus. They did not require skilled labour for it at all. The men who worked it were ordinary stokers; and they soon learnt their duties. Wherever they had a machine requiring skilled men, the workmen "fancied" themselves, and wanted more money. The apparatus they had was capable of making from 300,000 to 350,000 cubic feet of gas per day. They were going to test it against other enriching processes. They were using it merely as an enricher. They found they could make a lower candle power gas at Dawsholm very cheaply. They wanted something that would bring up the quality of the gas without using the high-priced cannels. They intended, he believed, to try an oil-gas process later on, and to pit it against the water gas. When this was settled, perhaps they would be able to say something more about the matter. Most of those present had seen that day the Arrol-Foulis charging and drawing machines at work. They would have noticed that the charging-machine was different from any other in the method of delivering coal. In others, the charge was put in as a whole or at two operations; but in the Arrol-Foulis charger it was delivered in six pushes. The pusher went in a certain distance every time, with an automatic stop, so that the distance was fixed; but the quantity of coal coming down in front of the hopper they could regulate at will. They could vary the charges to any extent. If they had retorts, as they sometimes had, which heated better at one place than another, they would, in ordinary charging, run an equal charge all through; but with their machines they could, on finding that one part of the retort was better heated than another, just give that part an extra shot, and so get the full working power of the retort. It cost no more, except the cost of coal, to put in a 2, 2½, or 3 cwt. charge into a retort; and it entailed no extra trouble to the man in charge of the machine. They had had the machines working for some six or seven months; and they liked them better every day. Then it was the same with those machines as with the water-gas plant; they set ordinary labourers to work them. In fact, they rather preferred lads to work them—much lighter fellows altogether than the old heavy stokers, the men they used to employ for shovel charging. They could break-in a man in about two days to the working of either of the machines; and they certainly did their work very well. He did not know if it had been noticed at Dawsholm that the house all through was worked by machinery. The coal, after it went in, was not touched by hand at all until it got outside in the form of coke. It came in, and the coal-breakers broke it to the size required; it was then raised by the elevator into the hoppers, which filled the charging-machines. Each machine served 40 retorts. They would notice that for the coke they had on the lower floor tipping-waggons from which the coke was drawn out by a small engine. The whole house certainly worked very well; and they were liking it better every day.

The CHAIRMAN said the next subject before them was the oil-gas process, about which Mr. Yuill, with a winter's practical experience of it, would be able to tell them something.

Mr. A. YUILL (Alloa) said that the Committee of the North British Association of Gas Managers some time ago asked him to read a paper descriptive of the Peebles oil-gas process in July; and he felt that going into the matter now would be, to a certain extent, forestalling what he had to say then. He was somewhat in the position of Mr. Wilson, in that he did not want to give publicity to figures. He thought the better way would be, if any of the members wished information, for him to give it in the form of answers to questions. Regarding the figures of the President, he found that their make at Alloa, without going into details respecting it, cost about 8d. and a fraction per 1000 cubic feet for material. That was the mixture; and in dealing with it, they must take into account the illuminating power of the gas. They all knew that a mixture of gas, according to the illuminating power, varied considerably in cost. The difference between a gas of from 20 to 24 candles and one of from 26 to 30 candles would be considerable. But there was this difference, that the cost per unit of light with cannel and coal was less in proportion the higher they went in illuminating power. In the case of coal alone, the cost became more the higher they went. But he had not yet determined the exact proportions; and he need not go into that matter.

The CHAIRMAN asked Mr. Yuill to tell the meeting, in a few words, if he had found a profit in using oil during last winter, as compared with using cannel.

Mr. YUILL said he had not any statistics by him; but he might mention that their plant cost about £430, and they had paid the cost of it in about three months' working—from savings. They made between 5 and 6 million cubic feet of gas per day since September to the present time.

Mr. MACPHERSON: Is that comparing the cost with the cost of coal last year or the present year?

Mr. YUILL said their account for coal and oil this year would be about £1100 less than last year for coal. Against this, they must reckon that they had made a little less gas; and against it also, they must debit themselves with the difference in the price of coal. For these two items he would deduct (say) £400, which would still leave about £600. They had experienced no difficulty whatever in the practical working, more especially in the severe weather, when most people who had experience in working shales had felt some difficulty. Certain gentlemen were visiting their works at a very severe time in the beginning of this year; and at that time they found no diminution in the illuminating power of the gas. This furnished a practical proof of its permanency. A great many people had considered the cracking of the retorts as militating against the oil process. He admitted that they had had retorts cracked; but he had also had clay retorts cracked. He did not know how they were cracked; but he found that by running in oil the cracks were closed up by the carbon. All the cracks were found in the bottom of the retorts; and he thought that measures would be found to overcome the difficulty, which was a mere mechanical one.

The CHAIRMAN said the next subject was cooking, heating, and motive power. But this, he thought, spoke for itself; so they did not require to have any information upon it, and they would pass on to the penny-in-the-slot meter. He would be very pleased to have the experience of any gentlemen who might have adopted these meters. He might say that they put in 100 of them about three months ago; and they had given entire satisfaction. The price of their gas was 3s. 9d. per 1000 cubic feet; and it had been reduced to 3s. 4d. They charged 4s. 2d. for the gas consumed through these meters at first; so that the difference paid the extra cost of the meter. He had orders that day for about 400 more of them. By these meters they were reaching a class of people who would not otherwise be consumers, who did not like the idea of lodging a deposit of 10s., and who used oil. They had found a great demand for the meters.

Mr. T. D. HALL said he should like to know if these 400 prepayment meters meant 400 new consumers, or if they removed existing meters.

The CHAIRMAN replied that he had taken care not to replace consumers' meters. A great many of the houses in their district belonged to colliery owners; and it was into them the meters had been chiefly going. They were all new consumers.

Mr. J. B. TERRACE said he was sorry that the oil-gas subject passed off so quickly, as he wished to ask Mr. Yuill as to his experience with carbon deposits.

Mr. YUILL said that was a subject which would interest them. The carbon they found differed somewhat from the carbon in coal retorts. It appeared to be more dense; and he did not know whether or not there was any affinity between it and the iron of the retort. But this he knew, that there was a difficulty in removing it; it could be done by burning. They found that, when they heated by contact, the carbon accumulated very quickly; but that, when they heated by radiation, there was very little deposit. By burning an hour or an hour and a half every day, they could keep the carbon under control.

The company, along with some friends who had not been at the meeting, then dined together. The Chairman was thanked for his services in the course of the toast-list, which was a short one. Mr. Yuill was named as Chairman for next year's meeting.

NEW ENGLAND ASSOCIATION OF GAS ENGINEERS.

The Annual Meeting in Boston.

(*Concluded from p.* 653.)

Mr. N. W. Gifford, of New Bedford (Mass.), read a paper on "Lime-Boxes for Removing Carbonic Acid;" referring to results obtained with a set of boxes, each 13 feet by 8 feet, and 3 feet deep. The oxide used was home made, consisting of 30 to 40 lbs. of iron chippings to a bushel of sawdust, oxidized with ammoniacal liquor. A charge of 110 bushels would make a layer 2 feet thick; and it was revivified *in situ* by means of air. The make per annum is 45 millions; and it is frequently necessary to change several boxes in a day. There were four boxes, worked three on and one off; and, with the view of supplementing this overworked plant, two additional boxes of the same size as the others were provided. These were charged with lime, and changed on the appearance of carbonic acid at the outlet. The gas usually made consists of about three parts of coal to two of water gas, mixed before the purifiers. An analysis of the lime as ready for use showed about 30 per cent. moisture, 11 per cent. carbonate of lime, and 57 per cent. free lime; and a foul sample showed 21 per cent. moisture, 60 per cent. carbonate, and 17 per cent. free lime. For the month of January, the flow of gas was 8530 cubic feet per bushel of lime. Before the lime-box it averaged 2, and after it 0·5 per cent. of carbonic acid. This showed 128 cubic feet of carbonic acid removed per bushel of lime; and the analysis proved that the lime, which weighed 55 lbs. per bushel, contained 31½ lbs. of free lime per bushel, which was capable of taking up 152 cubic feet of carbonic acid. This showed a loss of efficiency of 3·07 lbs., or 24 cubic feet of carbonic acid per bushel—equivalent to 16·4 per

cent. Perhaps this loss was due to free lime remaining in the cores of the little lumps. Even if the whole of the lime had been free, the full quantity of carbonic acid it could take up would be 183 cubic feet, which, at 1·5 per cent., meant about 12,200 cubic feet of gas per bushel of lime. He had also found that gas purified from carbonic acid, if allowed to pass over carbonated lime, would again become charged with that impurity. Full details of the apparatus adopted for a series of experiments as to the effect of carbonic acid on the illuminating power of gas were given. Flat-flame burners were fitted at each end of an ordinary photometer-bar, and supplied with gas at the rate of 5 cubic feet per hour. One was fed direct from the gas supply; and the other from the same source, after passing a small lime purifier. A 17-candle gas, consisting of 8 per cent. water and 92 per cent. coal gas, was found to be improved to the extent of 18·5 per cent. by passing the lime-box, which removed 2 per cent. of carbonic acid. A mixture of coal and water gas in nearly equal proportions was improved 12·5 per cent. by taking out 1·7 per cent. of carbonic acid. The author next discussed the question of whether it was cheaper to take out the carbonic acid, or to bring up the candle power by enriching. From his figures, it appeared that the latter course would cost twice as much as the former. He also claimed that the absence of carbonic acid decreased the blue part, and gave a better appearance to the gas-flame; and he concluded by expressing a strong opinion in favour of the use of lime in addition to oxide for purifying.

Mr. Humphreys opened the discussion by saying that some years ago he went over similar ground, and arrived at the same conclusions as the author of the paper, although the effect of the carbonic acid appeared to him to be much less than was there stated. But lately he had been enabled to enrich more cheaply; and so he had not paid much attention to the subject. He also found some difficulty in using the lime after the oxide. He had four purifiers on one centre-valve, and after that two on another, so that he could not use the lime first. Sometimes sulphur would get forward with the gas; so at present he was rather "on the fence." Mr. Allyn remarked that many manufacturers of oxide incorporated lime with it; but he did not see that any benefit followed from the practice, as the lime was soon exhausted, and was then of no further use. Mr. C. D. Sherman was able to turn his gas through a set of oxide-boxes, or a second set of lime-boxes, either separately or together, and had experimented as to the effect of using lime, or otherwise, on the candle power. His gas averaged 20 candles without, and 21·8 candles with lime; or, in other words, an additional half gallon of naphtha per 1000 cubic feet would be required to compensate for the absence of lime. Mr. Hinman said that, with Argand burners or flat-flame burners at low pressure, the effect of a small percentage of carbonic acid in the gas was not very marked; but with a good pressure the deterioration was very perceptible. The degree of depreciation also varied according to the quality of the gas. If 1 per cent. of carbonic acid reduced 17-candle gas to the extent of one candle, it would not go over two-thirds or half a candle with 25 to 30 candle gas.

"The Gas Industry in 1886 and 1892," was the subject of a paper read by Mr. R. B. Taber. He chose 1886 because that was the year in which the first official mention of electric companies was to be found in the Massachusetts Government returns. Since that time, they had developed to the extent of £2,400,000 capital, and a capacity for supplying 18,500 arc and 217,000 incandescent lights. It was impossible to speak as definitely about petroleum; but during that period it had become much cheaper, and great improvements in lamps had also been made. During the six years, the consumption of gas had increased 42 per cent.: and additional capital amounting to about £2,700,000 had been invested. Over 300 miles of mains had been laid, and 25,000 meters supplied. The average price had fallen from 9s. to 7s. 7d. per 1000 cubic feet; and the profit in 1892 was 8·9 per cent. on the capital. The use of gas for street lighting was decreasing. In 1886, there were 18,000; and in 1892, only 13,000 lamps. But the consumption per consumer had increased from 14,000 to 22,000 cubic feet. The variations in this respect were noticeable. They ranged from a minimum of 12,000 to a maximum of 30,000 cubic feet; and the consumption per mile of main, from 36,000 to 10,400,000 cubic feet. The rate of increase in the consumption of gas was not altogether satisfactory; and he should like to be able to find out the share taken by it in the actual total illumination of a town or of a district. Some of the disadvantages of gas, as compared with electricity and oil, were discussed at length.

The President invited a full discussion of this important subject; and Mr. Stiness said he had several miles of unproductive main, and would be glad to know how to get any returns on the investment. His greatest competitor was kerosene oil; and there was a prejudice against gas companies, for which the Massachusetts Government and the Mayor of Boston were to some extent responsible. He was trying to push the incandescent light. Mr. Lamson thought that the matter was somewhat too broad for discussion in a general way. Both electricity and kerosene had made great strides during the last six years. In reply to Mr. Lane, Mr. Taber said that the present average earnings of electric companies were about 6 per cent.

A discussion on the value to be derived from coke and tar, used as fuel or otherwise, was next opened. Mr. C. D. Sherman said that the value of tar as a fuel was dependent on that of coke. He found that a gallon of tar was equivalent as a fuel to half a bushel of coke; and therefore, if coke was worth 4d. a bushel, tar was worth 2d. per gallon. Having tried tar, with and without steam, he much preferred the latter, though he did not care to introduce the steam-jet to new settings. Mr. Fowler remarked that he used his surplus coke for making steam; and found it worth 10 per cent. less under the boiler than good bituminous coal. Mr. Lamson said that a bed of retorts doing good work required 52 to 60 bushels of coke per diem. At 5½d. per bushel, this would cost about 24s.; and as the quantity of coal carbonized was 10,800 lbs., the cost would be 2·6d. per 100 lbs. of coal. A bed of retorts requiring 100 gallons of tar and 24 bushels of coke per diem, worked off 12,600 lbs. of coal. Figuring this out, it would be seen that tar was worth 2d. per gallon to burn. He also gave some details as to the use of coke and coal for making water gas. The average of a month's working was 39 lbs. of coke per 1000 cubic feet of gas made, from which there was a residue of 6 lbs. of cinders, which were fit to use as fuel under the boilers. The apparatus produced 580,000 cubic feet of gas per 24 hours; and the consumption of oil was 4·5 gallons per 1000 cubic feet of gas. A second experiment, extending over 26 days, gave a daily production of 609,000 feet of gas, with a consumption of 38 lbs. of coke and 4·25 gallons of oil per 1000 feet. An experiment with coal, covering 40 days, gave a production of 643,000 cubic feet per diem, or 45½ lbs. of coal and 4·4 gallons of naphtha per 1000 feet. Of the coal, 12 lbs. was obtained as a residue for boiler use, as before. Mr. M'Kay pointed out that, assuming tar to consist of nothing but carbon and hydrogen, its value could not be more than 1½ times that of pure carbon. Knowing the value of coal, he should not have thought that tar was worth much over 1d. per gallon as fuel; but perhaps the liquid fuel could be better distributed. Mr. Humphreys said that, in comparing tar with coke, there was room for a good deal of misunderstanding, as the results obtained with coke varied so much according to the kind of furnace used. He could heat a bench of six retorts, yielding nearly 50,000 cubic feet of gas per 24 hours, with 70 gallons of tar and 8 bushels of coke per diem.

In discussing the contents of the "Question-Box," a great deal of interest centred round the subject of fast meters. Mr. Allyn quoted from the Massachusetts State Inspector's report for 1893, which set forth that there were 87,000 meters in use in the State, of which 531 had been sent for testing. Of these, 3 would not register, 1 was variable, 284 were correct within the 2 per cent. limit, 197 were fast, and 46 were slow. The average error of the fast meters was 5·1, and of the slow 9·3 per cent.; and the average of the whole 527 was 1·23 per cent. fast. The percentage proportion was 53 correct, 37 fast, and 8 slow. Mr. Allyn went on to argue that this was not a fair sample; and that, in justice to the gas companies, it should have been stated that the whole of the 531 meters were claimed to be fast. Nobody complained of the slow meters. In his own district, he had tested each meter removed; and, out of 697, he found 65 per cent. correct, 16 per cent. slow, and 19 per cent. fast. Mr. Neal regretted that notice of the question was not given, as he could have been prepared with some information.

The question of "Federation," which was under the consideration of the American Association, next came before the meeting; and a Committee was appointed to report on the matter. They were authorized to take a postal ballot on the question of the desirability of Federation.

Mr. Slater, jun., presented a request from the American Association, who had arranged, in order to facilitate business at their meetings, that the papers should be published in advance; and many would be read by title only at the meetings. This would leave them more time for discussion; and they now asked permission to select papers read at other Associations for discussion from time to time. This request was referred to the directors, with power to act. The meeting then closed.

LONDON COAL GAS AND ITS ENRICHMENT.

By Vivian B. Lewes, F.I.C., F.C.S.,
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A Paper read at the Society of Arts last Wednesday.

Although the first centenary of coal gas was celebrated two years ago, another thirteen will have to elapse before we can commemorate the completion of the first hundred years of its practical use in London as an illuminating agent; and as the past few years mark a distinct epoch in the history of the gas industry, and as the air is full of changes yet to come, I propose to bring before you in this paper, in as brief a space as possible, a history of the past, as far as it concerns our great City, and a review of the present condition of our gas supply from the point of view most likely to interest the consumer. In doing this, I shall restrict myself, as far as possible, to the area in which I am most interested—that is, the City of London; but it must be borne in mind that the largest proportion of the Metropolitan district north of the Thames is supplied by the same great Company that supplies the City, and that most of my remarks will apply equally well to the gas supplied to the district south of the Thames by the South Metropolitan Gas Company, and also to the portion of North-east London supplied by the Commercial Gas Company.

The first mention of any gas lighting in the City was in 1807, when an experiment was made in lighting part of Whitecross Street and Beech Street with gas. This having proved successful, the Chartered Gas Company obtained the first Gas Act in 1810, granted by Royal Charter (hence the name "Chartered"); their lighting powers extending to the City of London, Westminster, and the borough of Southwark. In 1814, mains were for the first time laid in the City; and on Nov. 9, 1815, the Guildhall was illuminated by gas. In that year also the Chartered Company entered into a contract with the Commissioners of Sewers to light several streets in the wards of Cornhill and Cripplegate.

After a lapse of seven years, the City of London Gas Company was formed, and obtained a Gas Act in 1817, to light very nearly the same area. Up to 1823, the two Companies having powers over practically the same area, there was keen competition between them; but in 1822, Sir W. Congreve, who had been appointed, on behalf of the Crown, to inquire into the gas supply of the Metropolis, advised that districts should be assigned to the Companies. Though this was keenly opposed by them, an Act was passed in 1823 carrying his recommendation into effect. The City was then divided between the City of London Gas Company and the Chartered Company; the City Company having that portion which comprises the western and southern part of the City as bounded by Aldersgate Street, Cheapside, and Fenchurch Street, while the Chartered Company supplied the portion comprising the northern and eastern part of the City. This arrangement, of course, put an end to competition between the two Companies, and left the gas supply as a monopoly in their hands. The representatives of the Companies had to appear annually before the Corporation to tender for lighting the streets; but, as there was no alternative between accepting their tenders or returning to oil-lamps for City illumination, this had but little effect upon the price which the Companies were able to charge for gas. At these meetings it was the custom to draw the attention of the Companies to the reduction in the price of gas which competition was effecting in the districts surrounding the City of London; and it was then that the Companies announced their intention of either making a reduction or retaining the price of gas to the citizens during the ensuing year.

In 1825, the price of gas was 15s. per 1000 cubic feet. By gradual reductions, however, it had fallen to 7s. in 1844; and, after much agitation, it was further reduced, in 1847, to 6s. Dissatisfaction continued to be felt at this price, as it was contended, by experts in the subject, that the City was entitled to a much greater reduction, and that, owing to the large consumption concentrated into a small area, it was entitled to gas at a lower price than any other portion of the Metropolis; and the Gas Companies were informed that, if competition were offered, it might be accepted by the Corporation, unless further reduction in the price of the gas was at once made. The price suggested by the Corporation Committee as being an equitable one was 4s. per 1000 cubic feet; and the Companies were required to state whether they would, by gradual reductions, or within a reasonable period, lower the price to this figure. This the Companies positively and definitely refused to do; stating that it would be impossible to supply gas profitably at that price. They further declined to give any guarantee that it would be reduced below 6s.; and it was this refusal that first led to the organization of the Great Central Gas Consumers' Company.

The promoters of this new Gas Consumers' Company started out with the proposition that the City was, from its local conditions, entitled to have gas at a cheaper rate than the rest of London; and they also, under the advice of skilled experts, averred that a price of 4s. per 1000 cubic feet would be largely remunerative to the Company. Being supported by a numerous and influential body of citizens and gas consumers, and further supported by the Corporation, they applied to Parliament for an Act in 1849, and again in 1850; but their application was unsuccessful on both occasions. In 1849, however, they had applied to the Corporation for permission to put down pipes in the City, and had offered to execute a deed by which they bound themselves to supply gas to the consumers at a price never to exceed 4s. per 1000 cubic feet; and, further, to reduce the price to 3s. 6d. and 3s., whenever they could pay a dividend of 10 per cent. to their proprietors. The then City Solicitor (Mr. Charles Pearson) and Mr. Alexander Angus Croll, at one time Engineer of the Chartered Gas Company's Brick Lane station, were the chief promoters. The Commissioners of Sewers, relying upon the promises made, accepted the offer; and a deed, dated Feb. 12, 1850, between the Great Central Gas Consumers' Company and the Commissioners of Sewers, was accordingly executed for carrying out the arrangement. The promoters were allowed to lay down pipes; and, with the large influence they had acquired, they applied for, and gained, an Act of Incorporation as the Great Central Gas Consumers' Company, and in 1851 also entered into their first contract for public lighting.

As soon as the Great Central Gas Consumers' Company was formed, in 1849, the other Companies, stimulated by fear of competition, at once reduced the price of gas to 4s.; but the Commissioners of Sewers, feeling, from the attitude which the Companies had taken before competition had been suggested, that it was only by keeping up the competition that the price could be kept down, supported the new Company, on the understanding that 4s. per 1000 cubic feet would be henceforth the maximum price of gas in the City, which price might still further be ultimately reduced. The compact entered into with the Company was subsequently incorporated in the Company's Act of 1851; the result being that the citizens had gas supplied to them at 4s. per 1000 cubic feet until the passing of the Metropolis Gas Act in 1860.

About the year 1857, when the northern Companies districted, the Gas Companies surrounding the City combined, with the idea of stopping competition. In view of the opposition received from delegates from various Local Boards in the Metropolis, who were defending the public interest against the coalition, Parliamentary Committees were appointed, in the years 1858-9, to inquire into the gas supply of the Metropolis; and, as a result of their labours, the Metropolis Gas Act was passed in 1860. The Bill was introduced into Parliament in April in that year, and was referred to a Special Committee of the House of Commons, who, after hearing a considerable amount of evidence, arrived at certain decisions which were apparently so favourable to the public and so distasteful to the Gas Companies that they withdrew their representatives altogether from the Committee, which concluded its labours on the 25th of June. The Companies meanwhile employed themselves in raising opposition to the Bill on its third reading; and succeeded in obtaining its recommittal; and, finally, having obtained the withdrawal from it of those features which they considered objectionable to their interests, the Bill ultimately passed. In the year 1861, the three Companies supplying the City raised the price of gas to 4s. 6d. per 1000 cubic feet; and the Commissioners of Sewers, who had been relying upon their agreement with the Great Central Gas Consumers' Company, took Counsel's opinion as to their being able in this way to increase the price. A special case was argued before the Court of Common Pleas in the year 1862, and decided in the Company's favour. This judgment was confirmed on appeal to a higher Court.

By the Act of 1860, the price of ordinary gas was fixed at a maximum of 4s. 6d. per 1000 cubic feet, with power to the Home Secretary to grant an increase, up to a limit of 5s. 6d., should the necessity arise. After the passing of this Act, the affairs of the Companies became very prosperous; and, in 1866, the Corporation promoted a Bill to construct gas-works and to supply gas in competition with the three Companies serving the City. After a fortnight's inquiry, however, it was rejected by a Select Committee. There was another parliamentary inquiry in 1867; and in 1868 a Bill was introduced for amending the Metropolis Gas Act, 1860. This Bill passed; and the Corporation acquired the power of purchasing by consent the undertakings of the Companies supplying the City—a power which, however, they never exercised. The Companies on their part obtained authority by this Act to amalgamate; and they were compelled after two years to raise the illuminating value of their gas to 16 candles, and reduce the price to 3s. 8d. per 1000 cubic feet, subject to going to the Board of Trade for a revision of price should it be necessary to maintain the dividends. In 1873 and 1874, the Imperial and Chartered Companies succeeded in establishing a claim for an increase in price up to 5s., under the revision clauses of the Act of 1868, as the coal famine of the preceding years had caused a considerable addition to their working expenses. Up to 1870, the supply of gas to the Metropolis was furnished by thirteen Companies; but between 1870 and 1876 six of these—the City of London, Great Central, Equitable, Western, Imperial, and Independent—all amalgamated with the Chartered Company under the title of "The Gaslight and Coke Company;" and they, together with the Commercial Gas Company, have supplied the whole of London north of the Thames up to the present.

At this time the South Metropolitan Gas Company were selling gas at 3s. per 1000 cubic feet; and, at the instigation of the City authorities, an inquiry was held by a strong Parliamentary Committee, presided over by the late Right Hon. W. E. Forster, whose proceedings occupied a month in 1875. Before this Committee Mr. George Livesey gave evidence, and suggested identifying the interests of the consumers and the Companies by an arrangement now known as the sliding-scale. The principle suggested was approved by the Board of Trade; and it was incorporated in the Acts obtained by The Gaslight and Coke and South Metropolitan Companies in 1876. By the former Company's Act, the price of 16-candle gas was fixed at 3s. 9d. per 1000 cubic feet; and the dividend at 10 per cent., which might be varied, subject to an increase or decrease in the price of gas, to be calculated as follows: For every penny or part of a penny charged in excess or diminution of the standard price, the rate of dividend might be increased or diminished by 5s. per £100 per annum; this principle being known as the "sliding-scale." As at present the price of gas has been reduced by 8d., the dividend payable by the Company is 12 per cent. Provision was also made as to the application of excess of profits over the standard rate of dividend, and that all new capital should be sold by auction or tender. This arrangement remains in force down to the present time, as The Gaslight and Coke and other Gas Companies' Acts Amendment Act, passed in 1880, only dealt with regulations of the supply of gas and its purity.

The changes in the price of coal gas supplied to the City will be found in the following table :—

Year.	Rate per 1000 Cub. Ft.	Year.	Rate per 1000 Cub. Ft.	Year.	Rate per 1000 Cub. Ft.	Year.	Rate per 1000 Cub. Ft.
	s. d.		s. d.		s. d.		s. d.
1826 . .	15 0	1850. .	5 0	1865. .	4 6	1880. .	3 4
1834 . .	10 0	1851. .	4 0	1866. .	4 0	1881. .	3 2
1837 . .	9 0	1852. .	4 0	1867. .	4 0	1882. .	3 2
1838 . .	9 0	1853. .	4 0	1868. .	4 0	1883. .	3 2
1839 . .	9 0	1854. .	4 0	1869. .	4 0	1884. .	3 0
1340 . .	9 0	1855. .	4 0	1870. .	3 9	1885. .	3 0
1841 . .	9 0	1856. .	4 0	1871. .	3 9	1886. .	3 0
1842 . .	9 0	1857. .	4 0	1872. .	3 9	1887. .	3 0
1843 . .	9 0	1858. .	4 0	1873. .	4 4	1888. .	2 9
1844 . .	8 0	1859. .	4 0	1874. .	5 0	1889. .	2 6
1845 . .	7 0	1860. .	4 0	1875. .	3 9	1890. .	2 9
1846 . .	7 0	1861. .	4 0	1876. .	3 9	1891. .	2 9
1847 . .	7 0	1862. .	4 6	1877. .	3 6	1892. .	3 1
1848 . .	7 0	1863. .	4 6	1878. .	3 6	1893. .	3 1
1849 . .	6 0	1864. .	4 6	1879. .	3 6	1894. .	3 1

Having now traced the history of the City gas supply and the changes in price which it has undergone, we will turn to the gas itself, and see what variations have been taking place during the past forty years in its illuminating power and composition. Ever since Bouguer introduced the idea of expressing the illuminating power of illuminants as being of so many candles value, this unit of light has been employed; and, under certain defined conditions, the London gas supply has to emit a light equal to 16 sperm candles of the size known as "sixes," and consuming the sperm at the rate of 120 grains per hour. The amount of light emitted by a gas-flame is entirely dependent upon the form of burner by which it is consumed; and the variations which have taken place in the standard burners employed for gas testing have given rise to the idea that the quality of gas supplied by the Metropolitan Companies is far higher than it was forty years ago; but when we come to carefully examine into this subject, we find that this is purely fallacious.

Up to 1850, but little attention was paid to the illuminating value of the coal gas supplied to the Metropolis; but in that year a Bill was passed, which enacted that the light emitted by a brass Argand burner with 15 holes, consuming 5 cubic feet of gas per hour, should be equal to the light of 12 wax candles, of the size known as "sixes." These wax candles were, however, only equal in illuminating power to 10·3 of the sperm candles at present used for testing purposes; so that when, in 1860, an Act changed the illuminating power to 12 sperm candles, it meant an increase of 16·5 per cent. in the illuminating value of the gas. In 1868, this was again raised to 14 candles; and by the Act of 1876, this was increased to 16 candles, and remains so to the present time. To the uninitiated, this gives the comforting reflection that, although the price of gas has been falling, we are being supplied with a quality which emits 55·3 per cent. more light than the gas sent out from the works in the years immediately following the passing of the Act of 1850. But when we examine the changes which have also taken place in the methods by which the gas has been consumed for testing purposes, we find that, although we have this large nominal increase in illuminating value, the actual light obtained by the consumer remains the same.

In 1864, the 15-hole brass Argand was discarded as a standard testing burner, and was replaced by a 15-hole steatite burner, which, by increasing the temperature of the flame, developed 11 per cent. more light; while in 1869 the "London" Argand 24-hole burner was introduced, and gave a still further increase in the light obtained from the gas, amounting to over 17 per cent. If we translate the light emitted from the gas sent out by the Chartered and Great Central Gas Companies in the years from 1852 to 1863, from terms of the old 15-hole brass burner, into the light which would have been emitted by the burner we use to-day, we find by the table that the results are practically identical:—

Year.	Brass 15-hole Argand. Candles.	Steatite 15-hole Argand. Candles.	"London" Argand. Candles.
1854 ..	12·72 ..	— ..	16·39
1868 ..	— ..	14·09 ..	16·34
1894 ..	— ..	— ..	16·60

And when, leaving the photometric side of the question, we approach the purely chemical aspect, we find no change has taken place in the composition of the gas which would lead us to expect any very great alteration in its illuminating value. This is shown by the following table, giving the composition of the gas supplied to the City:—

	1851.	1876.	1884.	1894.
Hydrogen	51·81 ..	50·28 ..	47·99 ..	53·36
Saturated hydrocarbons . .	35·25 ..	36·95 ..	37·64 ..	32·69
Unsaturated hydrocarbons .	3·53 ..	3·22 ..	4·41 ..	3·58
Carbon monoxide	8·95 ..	4·37 ..	3·75 ..	7·05
Carbon dioxide	nil ..	nil ..	nil ..	0·61
Oxygen	0·08 ..	0·22 ..	0·26 ..	0·21
Nitrogen	0·38 ..	4·96 ..	5·95 ..	2·50
	100·00 ..	100·00 ..	100·00 ..	100·00

Analysts—E. Frankland, Humpidge, P. Frankland, and Lewes.

On examining these analyses, we see, however, that a distinct change has taken place in the proportions in which certain constituents of the gas exist. The constituents of coal gas may be divided into three classes: (1) Those which give the illuminating properties to the flame; (2) the combustible diluents which give size and body to the flame; (3) impurities, which are generally as small in quantity as they can in practice be obtained. In the above table, the hydrocarbons, upon which the luminosity of the flame mostly depends, belong to the class which we term "unsaturated hydrocarbons;" while the combustible diluents consist of the saturated hydrocarbon methane, hydrogen, and carbon monoxide. On examining the analyses of The Gaslight and Coke Company's gas made in 1884 by Dr. Percy Frankland, and one made this year by myself, it will be seen that the hydrogen is nearly 6 per cent. higher, the carbon monoxide more than 3 per cent. higher, and the saturated hydrocarbons 5 per cent. lower than they were ten years ago; and although this has no practical effect upon the illuminating power, this change in composition has brought about a curious phenomenon with regard to the size of the flame.

A year ago my attention was called to the fact that many consumers of gas within the City were noticing a considerable increase in their gas bills, with no corresponding increase in the number of burners in use, or in the hours during which the gas was consumed; and I was instructed by the Corporation Committee for County Purposes to find, if possible, the cause for this. In several cases there was nothing to give any clue as to the reason for this phenomenon, as the meters had been regularly tested, no alteration made in the number or form of burners used, and the gas had been consumed for exactly the same hours as before; and yet the consumption had been steadily increasing during the past three years. After endeavours—for some time in vain—to find the cause of this, I at length made an extended series of experiments upon the composition of the gas and the height of flame which it yielded; and I found that, up to three years ago, the flame emitted by a standard "London" Argand, when burning a 16-candle coal gas, at the rate of 5 cubic feet per hour, was exactly 3 inches, but that since that time the height of flame necessary to emit this amount of light had been steadily growing less, and at the present moment a 16-candle flame in the "London" Argand has a height of only 2·6 inches. The cause of this is that the height of a flame depends entirely upon the constituents of the gas; and whereas hydrogen gives an excessively short flame, methane, or marsh gas, will give one more than four times as long when burning at an equal rate of flow—the flame yielded by carbon monoxide being intermediate in size between the two. The following table shows the height of flame yielded by gas burning at the rate of 5 cubic feet per hour in a London Argand :—

Gas.	Inches.
Hydrogen	0·985
Carbon monoxide.	2·206
Methane	4·250

It is therefore evident that the alteration in composition, due to the increase in the quantity of hydrogen and carbon monoxide, and the decrease in the percentage of methane, has led to this alteration in the size of the flame. When a householder lights his gas-burners, he invariably turns on the gas until he gets the largest possible flame without roaring or smoking; and, from the alteration in the composition of the gas which has taken place, this means using far larger quantities of gas than heretofore. Consequently, although an increase in illuminating power is obtained, a substantial rise in the quarter's gas bill is also found.

There are two causes for the alteration which has taken place in the composition of coal gas, one of which is that, in the Metropolitan gas-works, it is now customary to use higher retort temperatures than were formerly employed; and this has only supplied by The Gaslight and Coke Company, but also by the South Metropolitan and Commercial Companies, as is tended to increase the percentage of hydrogen in the gas not shown in the following table :—

Constituents.	South Metropolitan Company.	Gaslight and Coke Company.	Commercial Company.
Hydrogen	52·22 ..	53·36 ..	52·96
Unsaturated hydrocarbons .	3·47 ..	3·58 ..	3·24
Saturated hydrocarbons . .	34·76 ..	32·69 ..	34·20
Carbon monoxide.	4·23 ..	7·05 ..	4·75
Carbon dioxide	0·60 ..	0·61 ..	0·75
Nitrogen	4·23 ..	2·50 ..	4·10
Oxygen	0·49 ..	0·21 ..	0·00
	100·00 ..	100·00 ..	100·00

The second cause at present affects the gas supplied by The Gaslight and Coke Company alone, and is to be found in one of the methods of enrichment which they adopt.

In large towns like London, where the Gas Companies have to supply a gas of specific illuminating power, and the gas is continually subjected to photometric tests at stations spread over the whole area supplied—any deficiency in the lighting value of the gas being visited with rigorously enforced penalties—enrichment, in some form or other, becomes a practical necessity. In London, the gas has to have an illuminating power of 16 candles; and, in order to ensure this over the enormous area supplied, it must be sent from the works testing up to 17 to 17·5 candles. With seaborne Durham coals, of the character most largely used in the Metropolis for gas making, the illuminating value of the gas will be about 15 candles; and

the gas manager has to enrich the gas by from 2 to 2½ candles before he can with safety send it out for distribution. This enrichment is done in several ways: (1) By the admixture of a certain percentage of cannel coal with the original gas coal; (2) by carburetting the coal gas with the vapours of volatile hydrocarbons; (3) by mixing the gas with carburetted water gas.

Up to four years ago, the admixture of a certain percentage of cannel coal with the Durham coal was the only method of enrichment employed by the Metropolitan Companies. About that time, however, the increase in the price of cannel forced the Companies to find some other process which should take its place; and The Gaslight and Coke Company tried experiments which led to their largely adopting carburetted water gas for this purpose. When steam acts upon carbon at a high temperature, the resulting action may be looked upon as giving a mixture of equal volumes of hydrogen and carbon monoxide, both of which are inflammable and non-luminous gases. The water gas is then carburetted—*i.e.*, rendered luminous—by passing it through heated chambers, in which oils are decomposed by heat, and the mixture of oil gas diluted with water gas is made of such richness as to give an illuminating value of 24 or 25 candles. This mixed with the poor coal gas brings up its illuminating value to the required limit; and during the winter months, the gas supplied in the City has mostly contained about 10 per cent. of the carburetted water gas. [Professor Lewes described, by the aid of a diagram, the method of producing gas by the modern Lowe process.] Carburetted water gas burns with a short but very brilliant flame, far shorter than that of coal gas—a 22-candle water-gas flame burning from a "London" Argand at the rate of 5 cubic feet an hour with a flame only 2½ inches in height; while a 16-candle flame of the gas supplied up to three years ago gave a flame 3 inches in height. By an extended series of experiments, I have been able to show that the coal gas now supplied and enriched with the carburetted water gas only gives a flame 2·6 inches in height, in order to emit a light of 16 candles, instead of 3 inches, as formerly was the case.

Under the Gas Companies' Acts, they are bound to supply a gas which, at the official testing-stations, shall emit a light equal to 16 sperm candles, consuming 120 grains of sperm per hour. As no parliamentary restriction is placed upon the composition of the gas, the Companies are perfectly within their rights in supplying gas of the kind now sent into the City; and the only remedy is to make it known to the gas consumers that, if they desire their gas bills to remain at the same figure as before carburetted water gas was used as an enricher, they must study the light emitted by the flame, and not its size. The gas sent out by the Commercial and South Metropolitan Companies, and also some portion of The Gaslight and Coke Company's gas, is not enriched by carburetted water gas, but by charging it with the vapours of highly volatile hydrocarbons until the desired illuminating value is reached (the Maxim-Clark process). Gas so enriched gives a flame of the same size as formerly; so that in the districts supplied with it, the increase in consumption has not been noticed.

Statements have been made in the public Press, and I have also heard the opinion expressed by private individuals, that the Gas Companies send out gas which is far below the standard illuminating value. In order to do this, the Companies would either have to provide one set of mains to conduct gas to the consumer, and another set to supply the official testing-stations, or else to specially carburet the gas close to the testing-stations; a third supposition being that some of the trunk mains can have no official testing-station attached to them near the points at which the distribution of the gas to the consumers commences. The first two theories would mean gross fraud on the part of the Companies, which it would be absurd to seriously consider, and moreover would not be practicable; while the third supposes carelessness on the part of the authorities empowered to look after the gas supply of the Metropolis. I can assert, from personal observation, that none of these causes exist in the area of the City. The Companies are compelled by Act of Parliament to supply gas of a certain quality; and the Gas Referees, who have to decide upon the meaning of the Acts and the way in which they are to be carried out, evidently translate this as meaning that the gas is to be supplied, to the area in which it is to be consumed, of the specified illuminating value. Interpreting the Act in this light, the official testing-stations are fixed at the points where the great trunk mains deliver the gas to the districts to be supplied; and it is only under exceptional circumstances that the illuminating value of the gas is ever found to be below the required limit at these points. In these big mains, the gas is continually flowing at a fairly steady rate, and is neither exposed to any great alteration in temperature, nor, from the size of the mains, to any very great amount of "skin friction,"—*i.e.*, rubbing of the gases against the sides of the pipes. But as soon as distribution commences, both these factors come into play; and as certain of the chief illuminants of the gas are vapours and not permanent gases, lowering of temperature causes condensation of some of them, while the power which friction against the sides of the main service-pipes, coated with deposited hydrocarbons, has of withdrawing the illuminants from the gas, still further decreases its light-giving value. Moreover, anywhere near the dead end of a service, stagnation in the gas during a large proportion of the 24 hours, when gas is not being consumed, adds still further to the trouble; and, even at the testing-stations, the influence of the small consumption of the gas on Sundays, and consequent stoppage in the manufacture on that day, can be traced in the illuminating value found on Monday morning.

The three official testing-stations are situated on the confines of the City area at Kinghorn Street, Cloth Fair; at the Aldgate end of Fenchurch Street; and in Dorset Buildings, Salisbury Square. My office, in Guildhall Chambers, Basinghall Street, may be taken to represent the heart of the City. The tests taken daily at my office are not official tests, because the office has not been certified by the Gas Referees, and therefore no legal action could be taken upon the results obtained; but as the *modus operandi* and the apparatus are the same as in an official testing-station, the results are of equal value as showing the illuminating power of the gas. The following results of an average week's testing will give an idea of the effect which distribution has upon the light-giving value of the gas:—

Date—1893.	Guildhall Chambers.	Fenchurch Street.	Cloth Fair.	Dorset Buildings.
Nov. 20—Monday	15·40	16·00	16·20	16·40
„ 21—Tuesday	15·30	16·30	17·00	16·60
„ 22—Wednesday	15·50	16·50	16·70	17·30
„ 23—Thursday	15·60	16·50	16·70	16·40
„ 24—Friday	16·00	16·80	16·60	16·80
„ 25—Saturday	16·20	16·90	17·20	17·10
Mean	15·66	16·50	16·66	16·76

Mean of the three official testing-stations, 16·64 candles.

If the construction placed on the wording of the Act is correct, the Gas Companies more than fulfil their parliamentary obligations as judged by the average of the year's supply; but if the light-giving value of the gas delivered to each individual consumer is to be a minimum of 16 candles, then the testing-stations would have to be at the end of the service, instead of at the intake, the check tests would have to be taken with portable photometers on the consumer's premises.

While, however, the public "strain at a gnat," and feel injured if the illuminating value of the gas falls to the slightest extent below the standard, they "swallow a camel" with the greatest suavity, and consume the gas supplied to them by methods of the crudest and most wasteful description. Of all the many questions which at the present time affect the coal-gas industry, there is probably none of more importance than the method by which gas is consumed. The Companies in London are tied down by the Legislature to supply gas of an illuminating power of 16 candles; and when we come to consider what this in reality means, we find that, by one of those subtle strokes of humour in which our legislative body occasionally indulges, it means to the consumer almost anything except a light equal to 16 candles. The amount of illumination which can be obtained by the consumption of coal gas is entirely dependent upon the method by which the gas is burned. From a so-called 16-candle coal gas, the consumer rarely obtains a value of more than 12 candles per 5 cubic feet of gas consumed; while by using burners of rational construction, upwards of 40-candle power could be obtained for the same consumption of gas.

The light emitted by a coal-gas flame is entirely dependent upon its temperature; and flat-flame burners, exposing a thin sheet of flame to the cooling action of the air, give the worst results. Argand burners are better, as the cooling is not so great; while the regenerative burners lately introduced, by utilizing the heat of the products of combustion for raising the temperature of the gas and air supplied to the flame, give an enormous increase in the light emitted. If the Gas Companies could only get a Bill passed authorizing the use of a regenerative burner as the standard, there is not the slightest reason why they should not call the gas at present supplied 40-candle gas. The consumer, however, using the flat-flame burner, would be obtaining only the light he did in 1850. Incandescent "mantle" burners, which act on a totally different principle, also yield a high illuminating value.

On carefully testing the burners in ordinary use, we find that, for an equal consumption of gas, the results at once show the enormous advantage to be obtained by regeneration, and also how serious is the loss which attends the employment of ordinary burners. The following table shows the quantity of light obtained per cubic foot of 16-candle gas consumed:—

Burner.	Candle Units.
Regenerative and incandescent	7 to 10·00
Standard Argand	3·20
Ordinary „	2·90
Flat-flame, No. 7	2·44
„ No. 6	2·15
„ No. 5	1·87
„ No. 4	1·74
„ No. 3	1·63
„ No. 2	1·22
„ No. 1	0·85
„ No. 0	0·59

These burners were by well-known makers; but there are plenty of cheap German nipples in the market which will give even worse results. In the above table No. 7 is the largest flat-flame burner given, as any larger size would never be used for indoor illumination; but with some of the big flat-flame burners employed for outdoor work, as much as 3-candle power per cubic foot of gas is developed by the best make, while it is also quite possible to find cheap imitations of them, which can

scarcely be distinguished by their appearance, only developing a little more than one candle per cubic foot. It seems probable that 10 candle units represent the maximum light to be obtained in practice per cubic foot from the so-called 16-candle coal gas, as, although greater regeneration will increase it as high as 16 units, the heat is so intense that the burner is quickly destroyed. Taking 10 candle units as being the maximum amount of light for a consumption of one cubic foot of gas per hour, we can now form an approximate idea of the waste of illumination which attends the ordinary methods of burning gas. If the burners most commonly in use in houses be examined, they will be found to consist chiefly of No. 4 and No. 5 flat-flame nipples; and I do not think I should be overestimating the number in use if I put them at 85 per cent. of the total. The remaining 15 per cent. is made up of the larger flat-flame burners, Argands, and regenerative lamps, which give a higher service; but it will be found that the total value obtained will not exceed 2·5 candles per cubic foot. This means that 75 per cent. of the total value obtainable from the gas is wasted, and that for our present expenditure in gas we could obtain four times as much light.

In the middle of January this year, the *Daily News* published an article on the quality and testing of London gas, in which a proposition was first made public that unenriched coal gas should be supplied to the consumers at a lower rate than is at present charged for the enriched 16-candle gas. This question is of such interest and importance to both consumers and gas companies, that any paper dealing with the present status of our gas supply would be incomplete without taking the subject into consideration.

As before stated, the coal gas, as made from Durham coal at the temperatures employed in the Metropolitan gas-works, has an illuminating power of from 14 to 15 candles; and the enrichment of this gas up to the required value costs far more *pro ratâ* than the amount of light obtained from the unenriched gas. This cost has to be borne entirely by the consumers; and the whole practical question to be decided resolves itself into this: "Is the game worth the extra candle and a half?" If coal gas were used for illuminating purposes only, I believe the consumer would be a considerable gainer by having the unenriched gas supplied at a lower price; and when we consider the amount of gas used as a fuel, and that the quantity so employed is daily increasing, the cost of enriched gas becomes of the greatest importance. One of our highest authorities on coal gas has computed the value of one candle in illuminating power in the gas supplied to London at £200,000. If his calculation is correct, the consumers in the Metropolis would be saved about £300,000 a year by using unenriched coal gas; and I venture to say that not one of them would notice any great difference in the light emitted by the gas with the burners ordinarily in use, while with regenerative burners the difference would be still less.

My reasons for the foregoing statement are as follows: I have already shown that the flat-flame burners, although convenient and easily fitted only develop a very small proportion of the light obtainable from the gas; and on testing No. 4 and No. 5 flat-flame jets with 16 and with 14·5 candle gas respectively, there is practically hardly any difference in the light emitted. It will take years to educate the consumer sufficiently in the methods of burning coal gas to cause the flat-flame burner to be generally discarded. During this period, he will be no sufferer by the change; while with the regenerative and incandescent burners which will eventually take the place of flat-flame burners any difference will disappear. In the regenerative burner, the increase in the illuminating value is largely due to the rise in temperature causing the methane, which forms about 34 per cent. by volume of the coal gas, to become a very valuable illuminant; and as there is just as much, or even more, methane in the unenriched gas, it is manifest that this increase will still be found. In the incandescent burner, the coal gas is burnt in an atmospheric burner, and the non-luminous flame is made to heat a mantle of refractory material up to incandescence; and for this purpose the 14·5-candle gas will do just as well as the 16-candle.

I have also shown that, in the distribution of coal gas, a 16-candle gas loses some of its value by condensation and the "skin friction" which it encounters in the small and exposed pipes; and one argument which has been raised against the lowering of the standard is that, if a 16-candle gas is reduced to 15 candles during distribution, a 14½-candle gas will be lowered to 13½, or a 15-candle gas to 14 candles. This, I think, is a mistake. An enriched gas is lowered in illuminating value because certain vapours are condensed from it; but it will be found that, with an unenriched gas, made at a high temperature, this action is decreased to a minimum, on account of the small proportion of vapours present. It is manifestly to the interest of the gas consumer and gas supplier alike that the price of gas should be reduced to the lowest possible figure; and it seems to me that the possibility of reduction in price is dependent upon the discarding of costly enrichment.

In concluding this account of the present condition of the London Gas Supply, I can only say that in no city in the world is the purity and illuminating value of the gas more rigorously looked after than in London; and in no city in the world do the Gas Companies more loyally strive to fulfil all the obligations placed upon them.

REGISTER OF PATENTS.

Distillation and Breaking-Up of Liquid Hydrocarbons and Similar Substances.—Clark, F. W., of South Norwood, S.E. No. 4510; March 1, 1893.

This invention relates to "the distillation and breaking-up of liquid hydrocarbons and other volatile liquids or spirits; and its object is to provide simple and efficient means for separating and collecting the different grades, or specific gravities, of such liquids."

Fig. 1.

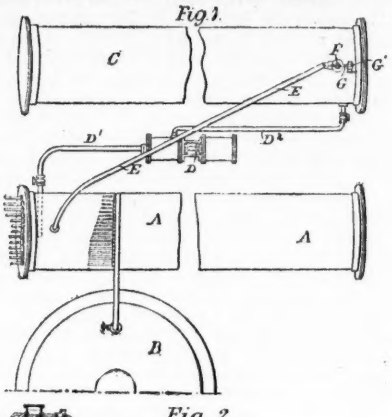


Fig. 2.

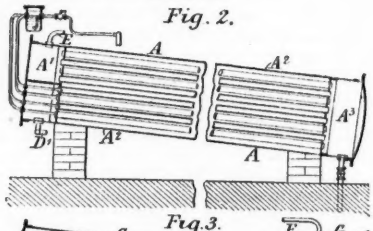


Fig. 3.

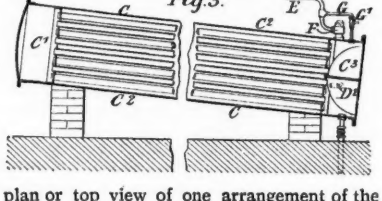


Fig. 1 is a plan or top view of one arrangement of the apparatus; fig. 2 is a longitudinal central section of the evaporator or retort; and fig. 3 is a longitudinal central section of the condenser. Fig. 4 is a plan or top view (partly in horizontal section) of another arrangement of the apparatus; while figs. 5 and 6 are a front elevation (partly in vertical section) and a transverse section of a modified arrangement of a feed-regulating box hereafter described.

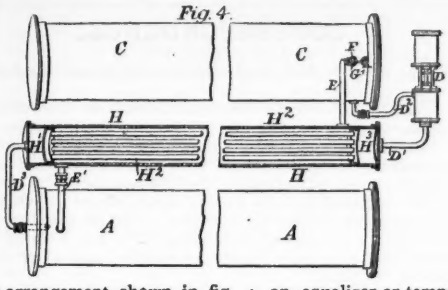
A is an evaporator or retort, preferably of cylindrical form, and divided into compartments A^1 A^2 A^3. In the central and larger compartment A^2 are tubes, which extend at their upper end through one division-plate into the compartment A^1, and at their lower end through the other division-plate into the compartment A^3. Steam, hot water, or other heating medium is circulated through the compartment A^2 outside the tubes; while a suitable carrier, such as air or other gas, is circulated through the tubes, as will be hereafter described. The compartment A^1 is divided by a horizontal plate or partition, so that there are as many tubes above as below the partition.

B is a tank or reservoir for containing the liquid to be distilled and broken up. This tank is connected with a regulating-box, also hereafter described. There are as many connecting branch-pipes as there are tubes below the partition in the evaporator or retort; and, in combination with each branch-pipe, is a pipe extending from the space in the upper part of the regulating-box into one of the said tubes, so that the liquid which enters the regulating-box through either branch-pipe will flow through the corresponding pipe into the corresponding tube. The evaporator A is preferably inclined, as shown in fig. 2, so that the liquid will flow by gravity towards or into the compartment A^3.

C is the condenser, also preferably of cylindrical form, and, like the evaporator, divided into compartments C^1 C^2 C^3, by means of plates. The central and larger compartment C^2 has arranged in it tubes, which extend at their upper end through a plate into the compartment C^1, and at their lower end through another plate into the compartment C^3. The condenser C, like the evaporator, is preferably inclined, as shown in fig. 3. Cold water, or other cooling medium, is introduced into, or circulated through, the compartment C^2, outside the tubes; the air or other carrier with the hydrocarbon vapour being passed through the tubes, as hereafter described. The compartment C^3 is divided by a horizontal partition, in such a manner that there are as many tubes above as below the partition.

D is an air-pump of any suitable description, the suction-pipe D^1 of which is connected with the compartment A^1 of the evaporator or retort below the partition; the delivery-pipe D^2 of the pump D being connected with the compartment C^3 of the condenser C below the partition. The space above the partition in the condenser is connected with the compartment A^1 of the evaporator or retort above the partition, by a pipe E, which is, if necessary, provided with a loaded or spring valve F, so constructed that the valve can be readily adjusted or regulated at will. A bye-pass G is provided around the valve, for the purpose hereafter explained; and in this bye-pass is arranged a stop cock or valve G^1.

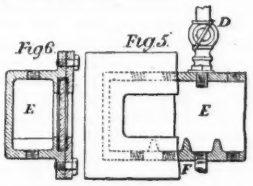
Fig. 4.



In the arrangement shown in fig. 4, an equalizer or temperature-exchanger H is employed, consisting of a cylindrical chamber, provided with tubes supported in tube-plates, which divide the chamber into compartments H^1 H^2 H_3. The compartment H^1 is connected by a pipe D_3 with the compartment A^1 of the evaporator below the partition; while the compartment H_3 is connected by the suction-pipe D_1 with the pump D, the delivery-pipe D^2 of which is connected, as above described, with the compartment C_3 of the condenser below the partition. The compartment H^2 of the equalizer is connected at one end by the pipe E to the compartment C_3 of the condenser above the partition, and at the other end by a pipe E^1 with the compartment A^1 of the evaporator above the partition. Therefore the heated air and vapour from the evaporator will be drawn through the tubes, while the cooled air from the condenser passes through the compartment H^2 outside the tubes; and an equalization or exchange of temperature will take place—the air and vapour from the evaporator being somewhat cooled before passing into the pump D and condenser C, and the air from the condenser being warmed before passing into the evaporator.

In working, the compartments A^1 A_3 of the evaporator or retort A, and the compartments C^1 C_3 of the condenser, and the pipes and tubes connected therewith, are first charged with a suitable carrier—such as air or other gas. The pump D is then started, and draws the air or other carrier from the evaporator or retort, and forces it into the condenser. At the same time, steam or hot water is caused to circulate through the compartment A^2 of the retort, and cold water or other cooling medium through the compartment C^2 of the condenser. The cocks then admit liquid from the tank B to the regulating-box; the cocks being so adjusted that the flow of the liquid through the several compartments of the box is about equal, and a thin or shallow stream of the liquid will flow through the tubes into each of the tubes below the partition. The supply of the liquid to all these tubes can then be simultaneously increased or diminished by means of the cock. As the liquid passes through the tubes, the more volatile portions of it are vaporized by the heat of the steam or hot water surrounding the tubes; and the vapour is drawn out of the evaporator or retort by means of the air or other carrier, and forced into the condenser by the pump D. The heavier or less volatile portions of the liquid pass through into the compartment A_3. The vapour thus forced into the condenser, in passing through its tubes, is condensed by the pressure therein, combined with the cooling effect of the cold water surrounding the tubes; and the liquid of condensation collects in the compartment C_3. The air or other carrier is forced from the condenser through the pipe E; the loaded valve F governing its flow through the pipe, in such a manner as to maintain the desired low pressure or vacuum in the retort and the desired higher pressure in the condenser.

Fig 6. Fig 5.



In the modification of the regulating-box shown in figs. 5 and 6, the branch-pipes D are connected through the cocks with the top of the box E, and deliver the liquid into shallow compartments in the lower part of the box. With each of these compartments is connected a pipe F, for conducting the liquid into one or other of the tubes of the evaporator or retort. The cocks should be so adjusted that, as nearly as possible, equal quantities of liquid flow through the several pipes F into the corresponding tubes.

The apparatus may, if desired, be so constructed that air will be drawn into the evaporator from the external atmosphere, and will be forced through the condenser and allowed to escape through a loaded valve. It is, however, preferable, says the patentee, to charge the apparatus, in the first instance, with air or other gas, and to circulate it continuously through the apparatus, as explained; because loss of the hydrocarbon vapour is thus avoided.

The inventor says that, if he used coal or other gas as the carrier for conveying the vapour from the evaporator or retort, he would conduct the gas enriched by the hydrocarbon vapour directly from the evaporator or retort through a pipe or main, to be used for lighting or other purposes, instead of conducting it through a condenser or condensers as described.

Manufacture of Coke and Coal Gas, and Obtaining Bye-Products.—Dvorkovitz, P., of Canonbury, N. No. 5546; March 14, 1893.

This invention relates to apparatus whereby rapid coking of coal is effected, and a great yield of both gas and bye-products ("coal paraffin oil") are obtained.

The oven, retort, or chamber in which the coal is treated, is constructed in such a manner that heat may be applied not only on the exterior, but to the interior—among the mass of coal therein. The external heat may be derived from generator gas, caused to circulate through flues arranged in the brickwork of the chamber in a circuitous course. But, in order to thoroughly heat the mass of coal rapidly, there is introduced, at any suitable part, hydrogen, in the form of water gas or coal gas or highly superheated steam, and either alone, or in combination with air, so as to mingle with the coal and rapidly effect the coking thereof, by the heat of the gas introduced at a temperature above the initial heat of the interior and its heated contents.

Figs. 1 and 2 are elevations at right angles to each other, and fig. 3 is a plan of the apparatus. Fig. 4 is a longitudinal vertical section; fig. 5, a part end elevation and part transverse section; and fig. 6, a part plan and part horizontal section of the apparatus.

A are two chambers or retorts, in which is placed the shale, coal, or other carbonaceous substance (such as wood or peat) to be treated. This is fed in through openings B, provided with covers C. The retorts are heated exteriorly by generator gas from a furnace D; the gas passing by a pipe or passage E, communicating by branches with chambers or flues F beneath the retorts. The flues F are connected, by other flues or passages G (formed in the brickwork up the sides of the retorts), with horizontal flues H at or near the upper ends of the retorts, and communicating with the chimney I. The generator gas passing through these flues effects the external heating of the retorts; while they are heated in the inside by water gas, generated in furnaces K. This water gas as it is generated passes through pipes or passages L, communicating by a pipe M with the interior of the upper part of each of the retorts. That which is admitted to the retorts at a

Fig. 1 Fig. 2

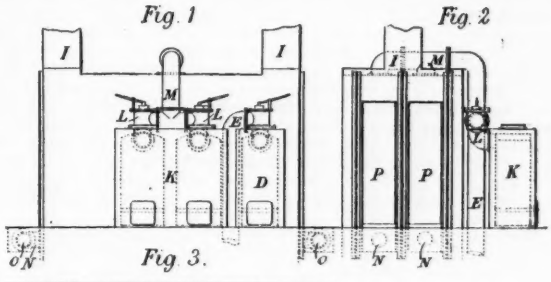


Fig. 3.

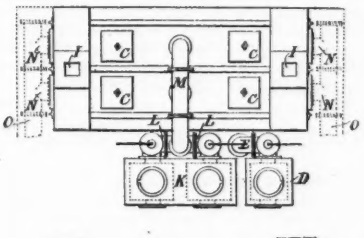


Fig. 4. Fig 5

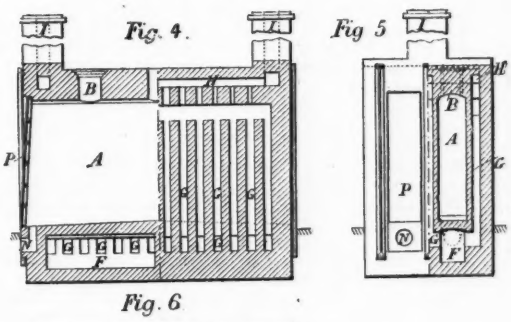
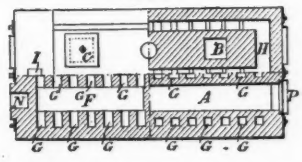


Fig. 6



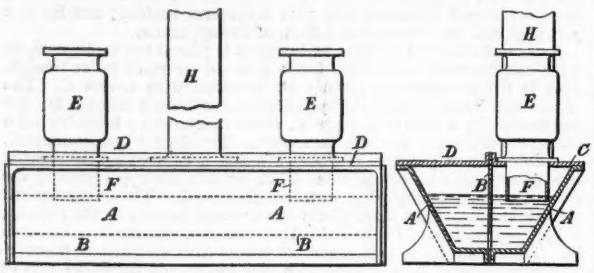
temperature above the initial heat of the interior of the retorts, mingles with the coal and separates the volatile constituents, which then pass through pipes or passages N, and thence to pipes O to apparatus wherein the separation of the bye-products and the purification of the gas are effected.

The illustrations show two chambers or retorts arranged side by side; but, if desired, only one may be provided, or more than two may be combined in one apparatus. They are formed at each end with a door P, made removable; and when the coke is discharged and the doors replaced, in readiness for a fresh charge of coal, valves admit the water gas to the interior of the retorts, and govern the admission of generator gas for heating the exterior of the retorts, ready for a repetition of operations.

Referring to his proposals, the patentee says: "I find in practice that in an oven, retort, or chamber containing a charge of coal of 5 tons, a stream of water gas equal to about 5000 cubic feet per hour, at a temperature of 1200° Fahr., gives good results. The coke obtained will be found to be free, or practically free, from sulphur; and therefore it is better adapted than ordinary coke for use, more especially for metallurgical operations. On account of the internal heating, the external heat applied in conjunction with the internal heating described, may be less than that ordinarily applied exteriorly. The hydrogen will enable ammonia to be produced, as it takes up the nitrogen."

Hydraulic Mains.—Dinsmore, J. H. R., of Liverpool. No. 5648; March 16, 1893.

The illustration shows one form of hydraulic main according to this invention, as applied to gas apparatus operating according to the "Dinsmore" process, and wherein the gas is carried down from the gas-making apparatus into a hydraulic main, and thence to a dry main.



Within the hydraulic main is a partition or septum B. C is a cover on one-half of it, making a tight chamber on that side. D is a loose plate, covering loosely the other side of the trough, and enabling the atmospheric pressure to act upon the surface of the liquid therein. E are descension-pipes, by which the gas is conveyed to the hydraulic main. F are the dip-pipes on the end of the pipes E, within the main. H is the dry main, by which the gas is carried off. The septum B does not reach the bottom of the hydraulic main (or is provided with apertures at its lower edge), so as to allow communication between the two sides of it; and the liquid is free to pass from one to the other. The pipes F dip into the liquid to a small depth only—say, for instance, a quarter of an inch; and this only when no pressure of gas exists in the producing apparatus. In that state the pressure on both sides of B is equal.

In operation, when the pressure of gas exists in that side of the main on which the descension-pipes E are provided, the pressure in that side, being greater than that of the atmosphere acting on the other side, depresses the liquid, and forces it up the other side. This unseals the ends of the dip-pipes F, and so allows the gas to pass away through the outlet-pipe H, without being subjected to the action of the liquor in the main. But when the make of gas ceases, the pipes F become again sealed, and act as dip-pipes to the gas-making apparatus.

Gas Stoves or Heaters.—Upton, C. S., of New York. No. 482; Jan. 9, 1894.

This gas-stove is formed by the combination with an annular base of a drum supported thereon; the top having a central hole supported by the drum. The burner consists of a series of radial pipes, communicating with a hollow hub at the centre, provided at the top with an interiorly screw-threaded hole. A screw-rod is adapted to pass through the central hole of the drum-top, and screw into the central hole of the burner, in such a manner as to hold the base, drum, and top firmly in place.

APPLICATIONS FOR LETTERS PATENT.

6152.—Fourness, H., "Manufacturing water-oil gas." March 27.
6169.—Sharp, J., "Coin-freed or prepayment gas-meters." March 27.
6233.—Duncan, W., "Guard for the mantles and like burners of incandescent gas-lamps." March 28.
6322.—Taylor, G., "Loading and discharging railway coal-waggons and vessels, and transferring coal and other substances from one place or level to another." March 29.
6359.—Bouvier, A., "Syphon test-boxes for gas-mains." March 29.
6376.—Campbell, K., "Rest or support for gas cookers as used on cooking-ranges." March 30.
6395.—Sharp, J., "Water-meters." March 30.
6425.—Brookes, A. G., "Suspended or aërial railways, destined to be employed in gas-works and other places for the transport of materials to and from purifiers and coal-stores, and for equivalent uses." A communication from F. D. Marshall. March 30.
6440.—Bray, G., "Gas apparatus for warming rooms and the like." March 31.
6503.—Dieren, T. Van, "Lighting gas burners, lamps, and the like." March 31.
6535.—Fehlen, A., and the Princess Company, Limited, "Heating and lighting apparatus." April 2.
6539.—Earnshaw, A., and Oldfield, T., "Gas or other explosive engines." April 2.
6549.—Abel, C. D., "Guide-frame work for gasholders." A communication from A. Klönne. April 2.
6679.—Pinkney, C. W., "Gas-producers or other furnaces." April 3.
6706.—Parkes, J. and J., "Gas-carburetting apparatus." April 4.
6737.—Braunschild, J., "Changing asbestos fibre into an incandescent body for incandescent gas-light." April 4.
6744.—Benier, L., "Gas-generators." April 4.
6755.—Low, P. A., "Gas-engines." April 4.
6806.—Dowson, J. E., "Gas-fired boilers." April 5.
6902.—Bagot, C. F. A. H., and Read, J. C. C., "Glasses or chimneys for lamps or burners for lighting or heating purposes." April 6.
6903.—Gurd, W. J., "Fluid-meters." April 6.
6905.—Bagot, C. F. A. H., "Lamps or burners for lighting or heating purposes." April 6.
6906-7.—Read, J. C. C., and Bagot, C. F. A. H., "Lamps or burners for lighting or heating purposes." April 6.
6936.—Thomas, J., "Automatic attachment to economize the consumption of gas in gas-rings or stoves for boiling or other domestic purposes." April 7.
6966.—Davy, D., "Gas and other internal combustion engines." April 7.

CORRESPONDENCE.

[We are not responsible for opinions expressed by correspondents.]

The Cost of Manufacturing Sulphate of Ammonia.

Sir,—Your weekly reviews of the tar and ammonia market have hitherto been so faithful, that distillers have for a considerable period made contracts for the purchase of both of these gas residuals on the basis of these market quotations. My firm has contracts running for upwards of 2,000,000 gallons of gas liquor, based on your returns. Your last three assessments of the values of liquor are, however, at a level that leaves a serious loss on manufacture; and I am induced by this fact to offer you such remarks respecting cost of production as will establish my case.

Differing estimates have been made in England, America, and Germany of the cost of manufacturing sulphate of ammonia, using varied types of plant; and on p. 207 of your issue of Feb. 2, 1892, a schedule of the expenses per ton of sulphate—totalling £3 12s. 2d.—was offered to your readers. Among the nine items into which the expense was divided, no mention was made of the cost of the disposal of the gaseous sulphuretted hydrogen, or of the lime and solid settlings, of tools, lights, water for boilers, and condensation; nor is aught allowed for wages of superintendence, chemical tests, office expenses, or depreciation and repair of plant. Only on the assumption that the estimate applies to the manufacture on the premises of a gas-works can the omission of the cost of the carriage of the liquor be justified; and even then the expense of pumping and overhead storeage requires estimation. To the manufacturing chemist, the expenses of transit of liquor form a variable, but serious item.

At the time the schedule in question was prepared, the demands of the sanitary and the alkali works inspectors were less exacting than they are to-day. Woe betide any distiller who is discovered burning his gaseous wastes, or discharging his residual liquors directly into sewers or streams. He may assuredly expect the unpleasant experience of being mulcted in heavy fines and costs. If anyone run these risks, his experience ought to be considered abnormal; and, in estimating the cost of manufacturing sulphate, the work of dealing with these gases and liquids must be recognized. Whether the gas is absorbed in ordinary purifiers or the sulphur extracted, the cost may be estimated at 2s. 6d. per ton. The cost of tanks for extracting the solid residue, and the labour of removing it, may be estimated to increase the cost of manufacture by 2s. per ton of sulphate. The tools used have a value. It is impossible to work economically with an intermittent plant; and light in a chemical factory is not *une quantité négligeable*. We may assume that these two items will add 1s. 6d. per ton to the total. The water consumed can, in exceptional cases only, be obtained for the cost of pumping. Most water-supplying corporations charge from 5d. to 1s. per 1000 gallons. The quantity used in our typical factory will, of course, vary with the type and size of the plant. Most managers find water condensation preferable. This factor I will assume to cost 1s. 3d. per ton of the final product. Wages of superintendence must be an important item in the schedule. It is so often not recognized. Every parcel of liquor arriving at the factory has to be gauged and tested; and the gaseous and liquid wastes call for daily examination. If we assume this agency costs 3s. 6d. per ton of product, we make a very low estimate of the manager's and chemist's skill.

Those who have been engaged in chemical work for a quarter of a century have seen whole plants discarded, and apparatus renewed several times. And it must be considered possible that our present plants will become old iron and rubbish in a very few years. All engaged in chemical manufacture recognize that very little indeed of our plant lasts longer than ten years. Ammonia distillers' plant consists of railway tank-waggons, tank-barges and lighters, pumps, storeage and settling tanks, drainage-floors, stills, saturators, &c., all depreciating as well as reparable. It may be assumed that 10 per cent. on the cost is a moderate estimate of this depreciation, *plus* the cost of every-day repairs. The capital employed per ton of sulphate made will be less in a large than in a small factory. Depreciation and repairs on the plant for a moderate output may be safely assumed to range from 12s. 6d. to 15s. per ton of sulphate. In "Lunge," this item is stated to equal 20s. per ton.

I would urge that your estimates for lime, fuel, labour, package, and discounts are too low. It will be readily admitted that the costs under these headings will vary with the situation of the works; and that the amount of fuel will somewhat depend on the pumping necessities. A gas-works where the minimum is required cannot fairly fix the normal. The outlay for lime will be regulated by the vicinity of lime-kilns and by the quantity used. I venture to fix the fuel at 3s. 9d. to 4s., and the lime at 2s. 9d. per ton of sulphate produced. Your assessment for labour is much too low. Mr. Watson Smith gives the cost, in a factory producing 389 tons of sulphate annually, at £250 per year, assuming that with a column still producing 2 tons of salt every 24 hours, four men are required. This cannot be doubted. A larger still, with more frequent saltings, will need three men per shift. Another difficulty in the labour account is the irregularity of the work. From October to May the work will be continuous; in the remaining four months—probably longer—the work will be fitful. But the workmen must receive pay in the summer weeks, notwithstanding the decreased production. This adds considerably to the average cost of labour, which cannot be estimated at less than 12s. 6d. per ton of sulphate. Then the labour of packing, including weighing, sewing, and loading, cannot be paid for at 10d. per ton. If a public weigher for metage and sampling is employed, this labour will absorb 4d. per ton; and it will take four men per day to bag up 25 tons of well-drained salt. The labour at the purifiers and settling-tanks must be a variable quantity, determined by the capacity of the apparatus, and therefore on the capital expended. I estimate packing at 1s. 6d. per ton.

There are numerous expenses connected with the clerical work of the office, with buying, and with selling, to which no reference has here been made. These total to a grave sum, and cannot, I maintain, be assessed at less than 5s. per ton. Very few financial estimates prove correct from which 5 per cent. for contingencies have been excluded. I estimate that 2s. 6d. per ton ought to be added under this head.

We have finally the question of the carriage of the liquor. Chemical works have ever been deemed unhealthy neighbours by the public, and have been located as far as possible in out-of-the-way places—as far from a resident population as contiguity to canals, rivers, and railways would permit. This consideration will probably grow in importance. Hence the carriage of raw material to the factory may become a serious item. It is now a variable quantity. Perhaps we may average it at 3s. per ton, including dues, tolls, unloading charges, &c.

The quantity of 5° Twaddel liquor required to produce a ton of sulphate is settled by arithmetic; as 12¼ tons of liquor, weighing 10¼ lbs. per gallon, and yielding 13¼ oz. of sulphate, will yield a ton of dry marketable salt.

Hence our total will be as under —

	£	s.	d.
Oil of vitriol	2	0	0
Purifiers for gas	0	2	6
Extraction and removal of lime mud	0	2	0
Tools and light	0	1	6
Bags	0	3	4
Water	0	1	3
Wages of superintendence	0	3	6
Depreciation and repairs	0	12	6
Fuel	0	3	9
Lime	0	2	9
Labour	0	12	6
Packing	0	1	6
Clerical work at office	0	5	0
Contingencies	0	2	6
Cartage	0	1	0
Carriage and f.o.b. charges	0	11	6
Total cost	£5	7	1

Sulphate has been freely offered this week at £13 12s. 6d. without finding buyers. This, less discount, equals £13 3s. 1d. per ton net. If from this sum we deduct our total expenses, we have £7 16s. to pay for liquor and carriage, and to provide interest on capital employed. Your price of 12s. 6d. per ton for liquor, *plus* 3s. per ton for rail or water carriage, will make this raw material cost £9 9s. 10d.; thus leaving the manufacturer a loss of £1 13s. 10d. per ton on the working, and nothing for his capital. Where no carriage is paid, your last week's maximum would just balance the account. But unless you positively state that the maximum applies only to such exceptional cases, and that to obtain an equitable price at the works the cost of carriage should be deducted, the seller will claim, and think himself defrauded if he fails to obtain, the maximum figure. Even in these rare cases, I must maintain that last week's quotation is 9d. per ton too high.

I fail to see in what item my estimate is excessive. If factories are loosely conducted, unhappy results are ultimately secured. These calculations are based on actual experience. It must follow that manufacturers accepting your market valuations must be, at the present making a very serious loss by the manufacture of sulphate of ammonia. Your weekly quotation affords a most convenient and valuable basis for contracts, and many would lament if it were not possible to continue to buy residuals by your scale of values.

There are many reasons why I am induced to ask you to conceal my identity. My facts are not less accurate, nor my conclusions less important, because I subscribe myself

April 11, 1894. A Manager of a Chemical Factory.

The Consumption of Water per Head at Leicester.

Sir,—I notice in the article on "Checking Waste of Water without Meters," in the last number of the Journal (p. 665), that the population of Leicester is put at five persons to a house. I suppose Mr. Griffith is correct; but this appears to me to be too low an estimate. There are 26,704 water-closets *only* for 40,607 houses; and I suppose there are few baths, or they would have been mentioned. In most well-regulated towns, every house is supplied with a water-closet; and at all seaside resorts most houses have two and even three, as well as a bath. Can such towns be supplied with water at the rate of 17·36 gallons per head? If Leicester was supplied as above, would not Mr. Griffith's estimate be from 30 to 35 gallons per head? This question is one of great importance; and if your readers would supply instances of the rate of consumption of water per head, to compare with the figures above, it would benefit many who are confronted with reports of such small averages not often really attained.

April 14, 1894. Turncock.

Improvements at the Wakefield Water-Works.—At the meeting of the Wakefield City Council on Tuesday last, a long discussion took place with reference to a recommendation from the Water Committee to the effect that their Engineer (Mr. Rofe) should be instructed to prepare working drawings for the proposed filter-beds at Jaw Hill and a service reservoir at Lindle Hill, with the object of doing away with the turbidity of the water and preventing lead-poisoning. An amendment was moved referring the matter back to the Committee on various grounds, the principal of which was the alleged excessive cost; but ultimately the motion was agreed to by fifteen votes to seven.

Serious Explosion of Natural Gas in America.—According to a telegram received through Dalziel's Agency, a terrible accident occurred at Alexandria (Ind.) at a late hour on the 1st inst., resulting in the loss of four lives, and the demolition of a handsome block of property known as the Whiteside building in Main Street. It is thought that a quantity of natural gas must have found its way into the basement of the building; and shortly before midnight it ignited. The building gave an ominous shake, and then a great portion of it collapsed; and fire broke out in the *débris*. Seven men were buried in the ruins. A relief party was quickly formed, and the rescuers strove hard to extricate the unfortunate victims of the catastrophe. In this, however, they were only partially successful; for though they were able to take three of the men out in a badly injured condition, the other four were literally roasted alive. After a while the charred bodies were recovered; but they were beyond recognition.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following progress has been made with Bills:—

Bill read the first time and referred to the Examiners: Alloa Water Bill.

Bills committed: Aberdare Local Board Water Bill, Bacup Corporation Water Bill, Newcastle and Gateshead Water Bill, Pontypridd Water (Tramroad) Bill, Swindon Water Bill, and Swinton Local Board Bill, to a Select Committee consisting of Earl Lauderdale (Chairman), Earl Romney, Lord Camoys, Lord Sinclair, and Lord Kelhead; to meet on Tuesday, April 17.

Petitions against the following Bills have been presented:—

Accrington Gas and Water Board Bill, from the Accrington Gas and Water Company.

Bacup Corporation Water Bill, from the Rawtenstall Corporation and the Rossendale Water Company.

Consett Water Bill, from Manufacturers and others.

Falkirk and District Gas Bill, from the Falkirk Corporation and the Stirling County Council.

Falkirk Corporation Gas Bill, from the Falkirk Gas Company, the Stirling County Council, and ratepayers in Falkirk, Larbert, and Camelon.

Kendal Corporation Gas and Water Bill, from the Manchester Corporation.

Newcastle and Gateshead Water Bill, from the Corporations of Newcastle and Tynemouth and the County Council of Northumberland.

Swindon Water Bill, from the Highworth and Swindon Sanitary Authority and the Wilts and Berks Canal Company.

HOUSE OF COMMONS.

The following progress has been made with Bills:—

Bill presented, read the first time, and referred to the Examiners: Wemyss, &c., Water Provisional Order Bill, to confirm a Provisional Order relating to Wemyss and to Buckhaven, Methil, and Innerleven Water.

Standing Orders complied with: Ambleside District Gas and Water Bill, Preston Gas Bill, South Hants Water Bill.

Bills read a second time and committed: Cardiff Corporation Bill, Southend Water Bill, Southwark and Vauxhall Water Bill (clause 13, asking for power to take additional water from the Thames, withdrawn), Torquay Gas Bill.

Bills referred to Select Committees:—

Ambleside District Gas and Water Bill, Chesterfield Water and Gas Bill, Hebden Bridge Gas Bill, Neath Corporation Water Bill, Paignton Gas Bill, and Plymouth and Stonehouse Gas Bill, to a Select Committee consisting of Sir J. Kitson (Chairman), the Marquis of Granby, Mr. Cochrane, and Mr. J. Burns; to meet on Wednesday, April 18.

Bury Corporation Bill, Cardiff Corporation Bill, and Gloucester Corporation Bill, to the Committee on Police and Sanitary Regulations Bills; to meet on Tuesday, April 24.

Carshalton and Croydon Gas Bill, Colne Valley and Central Middlesex Water Companies Bill, East London Water Bill, Harrow and Stanmore Gas Bill, Southwark and Vauxhall Water Bill, and West Middlesex Water Bill, to a Select Committee consisting of Sir J. Pease (Chairman), Mr. Rankin, Mr. Brunner, and Mr. Baird; to meet on Thursday, April 19.

London County Council (General Powers and Improvements) Bills, to a Select Committee consisting of Mr. Coddington (Chairman), Mr. M'Innes, Sir J. Weston, and Mr. Renshaw; to meet on Tuesday, April 17.

Thames Conservancy Bill, to a Select Committee consisting of Mr. Jackson (Chairman), Mr. Round, Mr. Paulton, and Mr. Oldroyd; to meet on Monday, April 23.

Bill reported: South Hants Water Bill.

Bill read the third time and passed: Alloa Water Bill.

Petition presented: From the Cardiff Gaslight and Coke Company, against the Cardiff Corporation Bill.

Petition withdrawn: From consumers of gas, against the Harrow and Stanmore Gas Bill.

The Consumption of Gas at Dukinfield.—The Manager of the Dukinfield Local Board Gas-Works (Mr. Harrison Veevers) reports that the total make of gas for the year ending March 25 last was 60,896,000 cubic feet, as against 59,791,000 cubic feet in the preceding year—an increase at the rate of 1·8 per cent.

The Treatment of London Sewage.—The first detailed analysis of the annual working of the two stations, at Barking and Crossness, for the disposal of London sewage, contains some statistics of interest. During the past year, 67,583¼ million gallons of crude sewage were received and treated; and 2,021,000 tons of sludge, of a moisture varying from 90·98 to 91·68 per cent., were sent to sea. In other words, a ton of sludge was extracted from each 32,000 gallons of crude sewage at Barking, and from each 35,500 gallons at Crossness. It is stated that 177,345 tons of absolutely dry solid matter was removed from the River Thames. The effluent produced at the two outfalls is said to contain solid matter in suspension of an average of 6·915 at Barking, and 5·834 at Crossness. Each sludge-ship carries, on an average, 1000 tons; and 2021 double voyages, of about 100 miles each, have been performed by the fleet of five vessels. Working expenses and capital expenditure taken into account, the cost of disposing of the sewage of London in the past year was £159,784, or a total average cost for precipitation, deodorizing, and conveyance to sea at the rate of about £2 7s. 3d. per million gallons on the gross quantity of 67,583¼ million gallons of sewage received and treated at the two outfalls at the rate of 18s. per ton for 177,345 tons of solid matter removed from the sewage.

LEGAL INTELLIGENCE.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

Tuesday, April 10.

(*Before Mr. Justice* CHITTY.)

Walker v. Lambeth Water-Works Company—The Bath Question.

This was an action brought to decide the question whether or not the Lambeth Water Company are entitled to charge 10s. per annum for fixed baths in dwelling-houses.

Mr. BYRNE, Q.C., and Mr. W. F. HAMILTON appeared for the plaintiff; Sir R. E. WEBSTER, Q.C., M.P., Mr. FARWELL, Q.C., and Mr. YATE LEE represented the defendants.

Mr. BYRNE, in opening the case, said the question was of considerable public importance, as a great many people would be affected by the decision. It came before the Court in the form of a special case, on which the facts were stated; but the action was brought to restrain the Company from cutting off the water from the plaintiff's house, by reason of his refusal to pay 10s. for water for a fixed bath. Plaintiff occupied, at Sydenham Hill, a house which was rated at £167 per annum; and the question really turned on the construction of certain clauses in the Lambeth Water-Works Act, 1848. By the 37th section of that Act, it was provided that the Company should furnish a sufficient supply of water for domestic purposes, on the request of the owner or occupier, at certain specified rates, with an additional charge for water-closets. The 38th section provided that it should be lawful for the Company to supply any person with water to be used for other than domestic purposes, on such terms and conditions as might be agreed upon; section 39 provided that the supply of water for domestic purposes should not include a supply for "baths, horses, cattle, or for washing carriages, or for any trade or business whatsoever." The question really was whether this exception of baths from domestic purposes included baths in a dwelling-house, or was not intended to apply to baths of a different kind which were carried on as a business.

Justice CHITTY asked if baths in private houses were common at the beginning of the century.

Sir R. E. WEBSTER said they were very uncommon in 1848.

Mr. BYRNE said he could remember a fixed bath in the house in which he lived in 1850. He pointed out that, in the Queen's printers' copy of the Act, the word "baths" had a capital B. If the construction put on the section by the defendants was correct, the Company need not supply water for any bath at all, whether fixed or moveable.

Justice CHITTY asked what a moveable bath was, and if it included a large basin?

Mr. BYRNE said he could not draw a definite line, and say what was and what was not a bath; but it was quite clear that anything which would be a bath if fixed would be equally a bath if disconnected, and filled by means of a pail, in which case the defendants did not contend that they could make an extra charge.

Sir R. E. WEBSTER pointed out that it was found in the case that ever since 1848 the Company had been accustomed to make this charge for fixed baths.

Justice CHITTY said that might show the interpretation put upon the Act at the time by the Company; but it was not conclusive.

Wednesday, April 11.

Mr. BYRNE, continuing his argument, further urged that, if the exception applied to baths at all, it applied to all moveable baths, and not only so, but the Company would be entitled, if they thought proper, to charge £10 instead of 10s.—there being nothing to limit the amount. They were simply empowered—not obliged—to supply water for other than domestic purposes; and they might impose such terms as it was impossible to comply with.

Justice CHITTY remarked that there was no question raised as to the reasonableness of the charge.

Mr. BYRNE said he only put this as throwing a light on the construction of the section.

Justice CHITTY said the case stated that it had always been the practice to charge 10s. for a fixed bath, and that the Company had never made any charge for water used for filling moveable baths.

Sir R. E. WEBSTER pointed out that 4 or 5 gallons of water would suffice for a moveable bath; but 30 or 40 gallons were used in a fixed bath.

Mr. BYRNE then quoted the case of *Weaver v. The Corporation of Cardiff*,* in which Justices Field and Mathew held that the plaintiff was not obliged to pay 2s. 6d. per quarter for a fixed bath, and that the case was not governed by that of *The Sheffield Water Company v. Bingham*. This judgment was affirmed by the Court of Appeal. There the section in the Cardiff Act was very similar to the one in the present case, and provided that the supply of water for domestic purposes should include one for a water-closet, but not for railway purposes, or for baths, washhouses, or public purposes, for horses or cattle, for washing carriages, for any ornamental purpose, &c., or for any trade, manufacture, or business whatsoever. Having quoted at some length from the case, and read the judgments in the Divisional Court and the Court of Appeal, the learned Counsel submitted that the Cardiff case was much more analogous to the present one than the Sheffield case, and that the Company had no right to make the charge in question.

Mr. HAMILTON followed on the same side. He said it was quite clear that "domestic purposes" would include the supply of water to a fixed bath; and but for section 29 the rate specified in section 37 would be sufficient to pay for it. The New River Act, passed in 1852, appeared to draw a distinction between fixed and other baths. His suggestion was that in this case the word "baths" meant public baths. He said it had been decided that the use of water for horses and carriages kept by private persons for their own convenience came under the term "domestic purposes."

Justice CHITTY asked if he contended that this was so in the present case. Could a person use the water for watering horses and washing carriages without paying an agreed charge?

Mr. HAMILTON at first said he did so contend; but, after a whispered consultation with his leader, he said he could not contend that.

Sir R. E. WEBSTER said that ever since 1848 the defendants had been making the charge in question, and had derived an income of many thousands a year from the water supplied for fixed baths. The Company had never made a charge for water carried about the house and put by servants into a bath, on the ground that this water was not supplied for baths at all. The Company had been in Parliament on five occasions since this practice had been in operation—viz., in 1856, in 1869, in 1871, in 1883, and in 1886—and this point had never been raised until now. It could hardly have been overlooked, because their friend Mr. Dobbs was not a gentleman of recent notoriety, for he (the learned Counsel) had the pleasure of appearing for him in 1879. Of course, if the construction were perfectly plain in his friend's favour, this observation did not go for much; but it was not without importance, as showing the meaning which had been attached to these words by all parties. The section was printed on all the notices sent to the customers. It must be remembered that the Company supplied a very large suburban district, in which the use of horses and carriages for private purposes was by no means exceptional; and if the view now put were correct, all the occupiers of villa residences would be entitled to say that, if a tap was fixed in the coach-house for washing carriages, it was not to be charged for—that it came within the term "domestic purposes." His friend must contend that water for such purposes could be demanded under section 37. The question of the quantity of water which could be demanded in relation to the supply required by the public had been for many years an important question in London. Section 37 dealt with what might be termed the absolutely necessary purposes of domestic supply. This supply the owner or occupier could demand; and there was no protection to the Company, except the penalties against waste. Then came other purposes for which the Company might supply water by agreement. But no question arose about their making exorbitant demands; and it was found that the rate charged for baths was reasonable. His friend picked out the word "baths," and said the construction the Company, put upon the section was unreasonable, or otherwise they might impose a prohibitive charge. But the same argument would apply to private horses and carriages. This was not a business way of looking at the question. The Company were anxious to sell as much water as they could, provided it did not interfere with the due fulfilment of their statutory obligations; and, of course, they would not impose unreasonable charges. If, however, the demand for water for other than domestic purposes became so great that there was a risk of the supply being deficient, he did not hesitate to say that it would be their duty to impose a very high, if not a prohibitive rate.

Justice CHITTY asked if the Company had to maintain a continuous supply.

Sir R. E. WEBSTER said about 60 per cent. of the Company's district was on the constant service, but, at present, not the locality where the plaintiff resided. In three years' time, however, it would be included. There was a practical difference between a fixed bath and a moveable bath or tub. In the latter case, there was not so much risk of the water being wasted; but in the case of a fixed bath, more water could be turned on to adjust the temperature. In support of the contention on the other side, it would be necessary to argue that, under the words "domestic purposes," private horses and carriages and cattle should get their water without any extra charge. Mr. Hamilton's contention that the words "baths, horses, cattle, or for washing carriages" referred to the occupation of a livery-stable keeper or the keeper of a wash-house, was not a reasonable one. The plain, simple meaning of the Act was that the Company were not compelled to supply water for any trade or business whatsoever; and that they were not compelled to supply, to persons who were not traders, water for a bath, or for washing horses or carriages, or for cattle. In conclusion, he submitted that the practice which had existed for 46 years of making a charge for water supplied to a fixed bath was a lawful one, and that the implication in law which arose from the water having been supplied, and the plaintiff having insisted upon the supply by maintaining his pipe and his tap, involved a corresponding obligation on him to pay 10s. per annum.

Mr. FARWELL, who followed on the same side, said Mr. Byrne's argument really came to this—that, in the 39th section of the Act, before the word "bath," one must either read the word "public" or strike out the word altogether. To do the latter was quite out of the question; and to limit the word to public baths was an exception to the statutory duty imposed by the 37th section upon the Company to supply water for domestic purposes. So far as public baths were concerned, there was a Public Act, dated two years before the Act in question, enabling—not compelling—water companies to supply to public baths and wash-houses. Taking the case of a laundress, for example, she lived in a house, and used a vast amount of water for the purposes of her business. This was not a domestic purpose, though the water was supplied to the house in which she lived. This case was really free from the differences which arose in many others where there were collocations of words which rendered it difficult to say they were purely exceptions. He did not agree with Mr. Byrne's remark that the Company were driven to saying that they could charge for baths, whether fixed or unfixed. It was a play upon words to say that the hip bath which one used in the morning was the same thing as a fixed bath to which water was laid on. For the purposes of the Company, it was a very different thing. The quantity of water used in the ordinary hip bath was a very small matter. Water was measured by thousands of gallons; and the Company might safely rely on the tendency of the human race, including servants, to economize their own labour. They would certainly not use more water than they needed for the pleasure of wasting it. His submission was that a fixed bath was an exception from what the Company would otherwise have, by statute, to supply. It could not be said that the Company would be compelled to supply a public bath; and therefore the only thing would be to adopt Mr. Byrne's argument as to inserting the word "public," or striking out the word "bath," which would make it absolutely meaningless.

* See JOURNAL, Vol. XLI., p. 777.

Mr. BYRNE, replying on behalf of the plaintiff, said the 39th section was an explanatory rather than an excepting section. The supply of water for domestic purposes must include the supply of water to a house for all purposes of consumption or of washing that were necessary for the reasonable enjoyment of the house. But for section 39, it was conceded that section 38 could not be held to include the case of a fixed bath. Section 39 enacted that a supply of water for domestic purposes should not include the supply of water for baths, horses, &c. In the first place, it was not the use the water was to be put to that regulated the matter; it was the supply of water. What it pointed to really was a separate and distinct supply for a separate and distinct purpose. The logical result of the defendants' argument was; "You shall not have a fixed bath at all in your house, or we shall not supply you with water."

Justice CHITTY: What they say is; "Under the name of supplying for domestic purposes, we are not bound to supply you with water for your bath."

Mr. BYRNE said it was not very material, in construing one Act of Parliament, to look to the language of another; but, as a matter of fact, there were several Acts in which fixed baths were expressly referred to. If the Legislature were to deal now with this question, they would look to the rates charged by the particular Company before them, because rates varied with the different Water Companies, and the defendant Company was a more expensive one than many of the others. If this Company went to the Legislature and asked specifically to be allowed to make a charge for fixed baths in dwelling-houses, it would be perfectly open to Parliament to say: "Very well; then your rates must be changed altogether." The argument on the other side really came to this—that, if a man wanted to have an ordinary modern bath in his house, the Company could refuse to supply it with water; and it would be the same if he wanted water for his horse, or for washing his carriage. But this, he submitted, was not a reasonable construction of the 39th section. It was for his friends to show that, on the construction of the clause, it would include the specific thing for which they were seeking to charge. In conclusion, he submitted that it was not a reasonable construction to put upon the Act of Parliament, if there was another possible construction, to say that the Company were to be entitled, if they chose, to refuse or to put a prohibitive tariff upon, the supply of water for the purpose of a fixed bath in a house. There was no logic in the distinction between the supply of one kind of bath or another.

Justice CHITTY observed that there was no allegation that the Company charged an exorbitant sum.

Mr. BYRNE said there was not. The plaintiff only contended that the defendants were going beyond their statutory powers.

Justice CHITTY, in giving judgment, said the plaintiff was the occupier of a house at Sydenham Hill, which was situated within the area of the water supply of the defendants. In his house he had a fixed bath, which was supplied with water from the Company's mains, passing through a tap affixed to the bath. The Company had, during the plaintiff's occupation, extending over some fifteen years, made a uniform charge, in respect of this bath, of 10s. a year; and it had been their practice, ever since their incorporation in 1848, to make a similar charge for baths of this description. The Company had never charged, or thought of charging, for a moveable bath, a hip, or a sponge bath. The plaintiff said the matter had recently been carefully investigated, with the result that, on the true construction of the Act of Parliament, the Company were not entitled to charge him for the fixed bath. The question, of course, turned upon the construction of the Act; and having seen many of these Acts, and having been referred to many of them in the course of the argument, he might say that this one was not open to the objection raised against so many similar documents, that they were stuffed full of words and complicated sections undoing and doing, and, after all, leaving the matter in a state of confusion. At any rate, it was correct to say that the plan of the Act was simple. Under the 37th section the Company were bound to furnish a supply of water for domestic purposes. That section enacted that the Company should, at the request of any occupier within the district who, under the provisions of the Act, should be entitled to demand a supply of water for domestic purposes, furnish to such owner or occupier or other person a sufficient supply of water for domestic uses, at the rates specified in the Act. The rates were based upon the value of the dwelling-house; and a distinction was made in the cases where there was a water-closet and in those where there was none—the rates being higher in the former. So far the obligation of the Company was plainly to supply water for domestic uses. By the 38th section, which was a mere empowering section, the Company took power to supply water within the limits for other than domestic purposes, upon such terms as might be agreed upon. Therefore there was no compulsion upon them to supply for other than domestic purposes. Thus far there was nothing special in the Act to show what was the meaning of "domestic purposes" or "domestic uses;" but then came the 39th section, which said: "A supply of water for domestic purposes shall not include a supply of water for baths, horses, cattle, or for washing carriages, or for any trade or business whatsoever." The plaintiff's argument was that "baths" must be interpreted in some sense so as not to include a fixed bath. He had done his best to gather from Counsel what limitation was to be put on the term "baths;" and he understood the result of the argument to be that the words "public baths" were to be read into the section. Then the observation was most obvious that there was an absurdity in supposing that the Legislature should say a supply of water for domestic purposes should not include a supply of water for public purposes. It was clear that the words used in the section were intended to exclude something which otherwise would have been a domestic use. Dealing with the words "horses, and washing carriages," one of the plaintiff's Counsel had felt himself constrained to say that they meant public horses, or where there was an establishment of horses, or a business of washing carriages, or the like; but again there was no ground that he could find, either on the words of the section or in the context, for inserting any such limiting words with regard to the horses, or for washing carriages. Though one case on these Acts of Parliament was not much guide or assistance, in determining another, there was a very pertinent decision of the Court of Queen's Bench, presided over by Lord Campbell.* In the case he referred to, the question was, when a horse and carriage were kept for private use, whether the water which was taken for them was applied to a domestic use. Lord Campbell, without dealing with anything special in the Act, said the horse and carriage were for private use, and were kept on the premises; and this being so, the water used for them was applied to domestic use. He (Justice Chitty) took this to be a clear and general decision, and one that was in point. That decision showed, as good sense showed, that there was no ground for inserting any words qualifying "baths, horses, cattle, or for washing carriages." Then came the words at the end, "or for any trade or business whatsoever." It was not "for any *other* trade." The Legislature here was careful not to put in the word "other," which would at once, of course, have brought the whole of the preceding subject-matters within the reach, at any rate, of the doctrine of *noscitur ex sociis*. It was "for any trade or business whatsoever." There might be some imperfection in the drafting; but he was not prepared to say that there was, because he could well conceive that there might be some trade or business carried on in a dwelling-house, the occupier of which would be perfectly entitled to demand a supply for his domestic purposes. The words "for any trade or business whatsoever" were words of greater caution, to preclude any such case as he had been suggesting. The 39th section of the Act spoke of a "supply of water for baths." It was said that the word "baths" must be construed so as to include everything that could fairly be called a bath in the house. The distinction, to which he had referred already, between a fixed and a moveable bath was most palpable. Every time the fixed bath in this particular case was used, from 30 to 40 gallons of water were consumed. When there was a moveable bath used in the house, a few gallons would suffice; and the occupier of the house, as a general rule, if the hip bath or a tub, or whatever it might be, was not in the particular room where the tap was, had to employ his servants for the purpose of carrying the water. This, of course, created additional labour, and made the consumption of the water a very different thing. Where a man, by merely turning a tap, could bring 30 or 40 gallons of water into his bath, he did it without any labour to himself; but when he or his servants had to carry water about the house, it was a very different state of things. This, as was said by Sir Richard Webster, was a practical question. However, although it was a practical question, it was one which did not arise in the present case, because the Company did not seek to charge, and had never sought to charge, for moveable baths of the description he had mentioned; and the observations he had made on the matter were rather extra-judicial. At the same time they appeared to be justified by a consideration of the obvious circumstances. In the present case, the water was supplied for the bath; and there was no escaping from that by any dexterity of argument. All kinds of suggestions had been made; one of which was this: Suppose there was a fixed bath in the house, could not the plaintiff draw water in the usual way from the cistern, and fill the bath? He (Justice Chitty) was not concerned with such a case—it was not one which was at all likely to arise; and he left it with the observations he had made. In his opinion, the plaintiff's case failed; but he would just allude at this point to the observation which fell from Lord Selborne in giving judgment in the Sheffield bath case.† Lord Selborne said that the bath which the Court in that case had to deal with was a fixed bath, supplied with water by the Company; and therefore it was not necessary to consider how the section would apply to baths of any other description not fixed, and not so supplied. He mentioned this to show that the Court of Appeal thought that such a bath as the one in the present case was distinguishable from a moveable bath.

The action was therefore dismissed; the costs being a matter of arrangement.‡

HIGH COURT OF JUSTICE—QUEEN'S BENCH DIVISION.

Saturday, April 7.

(*Before Mr. Justice* LAWRANCE.)

Grand Junction Water-Works Company v. Brentford Local Board.

This was an action in which the plaintiffs claimed from the Brentford Local Board £194 15s. 3d., the cost of maintaining and keeping in repair certain fire-plugs within the district of the Board during the last six years before the issue of the writ; the defendants having pleaded the Statute of Limitations. They were empowered to supply water within the district of Brentford by their Act of 1852, which incorporated the Water-Works Clauses Act, 1847, under the 38th section of which the undertakers were obliged, at the request of the Local Authority, to fix fire-plugs, and were authorized to charge for the same, and also for keeping them in repair. The defendants contended that they had never requested the plaintiffs to fix these fire-plugs, and were therefore not liable.

Mr. JELF, Q.C., and Mr. BAUGH ALLEN appeared for the plaintiffs; Mr. MURPHY, Q.C., and Mr. EARLE represented the defendants.

Mr. JELF, in opening the case, admitted that, with respect to the fire-plugs in question, no direct charge had been made by the defendants; but they submitted that the request was to be implied from the fact that they had been constantly in use, and that the defendants had from time to time asked the plaintiffs to send someone to point out where they were, in order that notices might be affixed to the walls indicating their position.

The following witnesses were then called:—

Mr. *A. Fraser*, M.Inst.C.E., Engineer to the plaintiff Company, said he entered their service in 1859 as Assistant-Engineer. There were about 225 fire-plugs in the district of the Brentford Local Board. When he went in 1859, he found a certain number delineated on a plan which he believed was made in 1852. Other plugs had been added

* *Busby v. Chesterfield Water and Gas Company*, JOURNAL, Vol. VII., p. 326.

† *Sheffield Water Company v. Bingham*, JOURNAL, Vol. XXXVIII., p. 129.

‡ It is understood that an appeal will be entered in this case, on the ground that Mr. Justice Chitty did not give a sufficiently broad interpretation of the word "baths" as used in the Company's Act of 1848.—ED. J.G.L.

since, as occasion required; he could not say exactly how many, but probably one-third of the whole. They were put in all new streets and roads. He described the method of fixing the plugs and boxes. In 1875 the Board called upon the Company to lower the fire-plugs to suit the road; and this was done—in fact, everything that had been asked had been done. They had letters from the Board requesting them to allow a turncock to meet their men to go round and point out the plugs, in order that they might put up notices; and this had been done more than once. If the whole of these plugs were now taken up and disconnected, and fresh plugs put down at the request of the defendants, it would cost probably about £1000. He had a recollection of a Volunteer Fire Brigade having formerly been in existence. During their time no claim was made by the Company; it was not put forward until recently. The expense of maintenance of the fire-plugs charged in the claim was, as nearly as possible, put at cost price. There was no profit charged; and the particulars were taken from the books.

Cross-examined by Mr. MURPHY: Until March, 1891, no claim for repairs was made against anybody in Brentford, as far as he knew, or as the books of the Company showed. In cases of frost, stand-pipes were put into the fire-plugs for the convenience of the public; but the Company were not obliged to do this. When the mains were flushed, they generally drew one of the end plugs. The fire-plugs were not necessary for this purpose; and if they did not exist, the work could be done in another way. He should be glad if there were no fire-plugs. In 1875, the Local Board bought water from the Company for watering the roads. This was obtained from water-posts with meters, which were the property of the Company, and for which they charged a rental to the Board.

Re-examined by Mr. JELF: They had had most pressing requests from the Board to put up stand-pipes in times of frost; and the Company never objected to their being used for this purpose. The 225 plugs were wanted for extinguishing fire alone. They had now in Brentford a constant supply, which was given voluntarily, and for which these fire-plugs were hardly adapted.

Mr. *J. E. Plummer*, Manager to Messrs. John Aird and Sons, gave evidence as to having laid mains in the Brentford district, and put in the fire-plugs. In former times, they were put in every 20 pipes, which was equal to a distance of 60 yards; but within the last four or five years, they were put in every 33 pipes, or 99 yards.

Cross-examined: About one-third of the present number had been fixed since 1869.

Re-examined: He could not say, without examination, how many had been put in since 1875, when the Local Board was constituted; but he would ascertain.

Mr. MURPHY, for the defendants, said this was an action based simply on a statutory right—not on a *quantum meruit* or anything else, but on a particular section of an Act of Parliament; and there could be only two possible questions in the matter. The first was whether there was a request at all, or whether one could have anything except an express request to entitle the Company to bring this action. For about forty years they had evidently thought no such right existed, for they had gone on supplying the different persons who wanted to use the plugs in question, which were put down by them at their own cost for the purpose of extinguishing fires; and until March, 1891, they had never suggested any such claim. If any request had been made, they must have known it; but it was practically admitted that there was no request. Under such circumstances, he submitted that a request could not be implied. Anterior to 1875, there was no liability implied on anyone to provide for extinction of fires.

Mr. JELF said he thought this was not quite correct. There was a section bearing upon the matter in the Towns Improvement Act, 1847.

Mr. MURPHY read the section in question, which set forth that town commissioners should cause fire-plugs and all necessary work and machinery for securing a sufficient supply of water in case of fire to be provided and maintained; but it was not suggested that in this district there were any such commissioners.

Mr. JELF here called upon his friend to read the concluding portion of the section, which stated that, for this purpose, they might enter into agreement with any water company or person.

Mr. MURPHY said this was the state of things in 1847; and it was not suggested that in this district there were any such commissioners or any authority bound to carry out that Act. By the 38th section of the Water-Works Clauses Act of the same year, the undertakers were to put down the plugs at the request of the local authority; and if these were so put down, the undertakers were entitled to charge for their maintenance. But it was absurd to suppose that they could put them down anywhere they pleased for their own convenience, and then call upon the local authority to pay the expense of maintenance. No doubt it was for this reason that the words "at the request" were inserted; and, as it was admitted that no request had been made, he submitted that there was no liability whatever upon his clients. If the plaintiffs had put them down without request, they might put them down, as they seemed to have done, at more frequent intervals than was required by the Act, and would thus cause an additional burden upon the persons who had to pay. The statute provided that the plugs were not to be more than 100 yards apart; and evidence had been given that, over a large portion of the district, they were placed as close as 60 yards.

Mr. JELF said Mr. Plummer had ascertained that the number of fire-plugs fixed from June, 1875, to June, 1893, was 87 out of the 225.

Mr. MURPHY said there was no request made for one of the plugs. It was a pure question of statutable right; and the condition precedent—viz., the request—had not been complied with.

Justice LAWRANCE, in giving judgment, said, whatever might have been necessary with regard to making a request in order to constitute the liability, it seemed to him that the whole state of things was altered entirely in 1875, when the duty was imposed on the Urban Sanitary Authority that they should cause to be maintained fire-plugs and all other necessary works for securing a sufficient supply of water in case of fire; and for this purpose they might enter into an agreement with any water company or person. Therefore they must either dig a well and provide water themselves, or lay their own mains, if there was no water company, or they might enter into an agreement with the company. This seemed to him to alter the case altogether with regard to the request. He had no doubt that the plugs put up since 1875 would come under the 66th section in the Towns Improvement Act, and that no request whatever was necessary with regard to them; but it was a duty imposed on the Urban Sanitary Authority that they should make an agreement with the water company unless they found it cheaper to do the work themselves. The Company only obtained their powers on conditions that they supplied water free for the purpose of putting out fires; and since 1875 he had no doubt whatever that the Sanitary Authority would be bound to see that the fire-plugs were forthcoming, and to enter into an agreement with the Water Company for this purpose. As they were only dealing with the last six years, he need not go into any question as to what took place between 1852 and 1875; and since then the Authority were bound to cause the plugs to be provided and maintained. The plaintiffs therefore were entitled to judgment for the full amount claimed—viz., £194 15s. 3d.—with costs.

On the application of Mr. MURPHY (Mr. Jelf not objecting), execution was stayed for a fortnight; and, if notice of appeal were given within this time, until the matter was disposed of.

The Ambleside Local Board and the Gas and Water Company.—At a public meeting of the ratepayers of Ambleside held a short time ago (see *ante*, p. 623), Mr. Jones demanded a poll after a resolution had been passed approving of the opposition of the Local Board to the Gas and Water Company's Bill, for the purpose of protecting the inhabitants of the district, and of obtaining powers to purchase the undertaking. The result of the poll has now been declared, as follows: In favour of the resolution 400; against it, 172.

The Price of Gas for Public Lighting at Liverpool.—At the meeting of the Liverpool Corporation Watch Committee yesterday week, the question of the price of gas supplied to the public lamps was further discussed. The Committee, after hearing a report by the Town Clerk on the subject, directed that gentleman to write to the Gas Company, informing them that there is no agreement between them to pay the price demanded for gas by the Company; but that the Committee are prepared to negotiate as to the price to be charged for gas supplied to the public lamps during 1894. In the meantime, and subject and without prejudice to the price that may ultimately be fixed, they are willing to pay the Company on account of gas supplied at the rate which prevailed in the year 1893.

The Newcastle-under-Lyme Gas Committee and the Local Government Board.—The question as to the payment out of loan moneys of the extra remuneration to the Gas Engineer of the Newcastle-under-Lyme Corporation (Mr. W. Winstanley) for the additional duties imposed upon him by the extension of the works, was again before the members of the Council at their last meeting. The minutes of the General Purposes Committee embraced a letter which had been received from the Local Government Board, inquiring whether the loan accounts had been recouped in accordance with the directions contained in the Board's letter dated Dec. 4 last. In consequence of this communication, the Committee had resolved that the Gas-Works Management Committee be requested to refund to the loans account the £100 paid to Mr. Winstanley. Some effort was made by one or two members to discuss the matter; but the Mayor (Alderman S. Hyslop) protested against this, as the question will again be brought up after the Gas-Works Management Committee have considered it. However, one gentleman expressed his opinion that the Gas Engineer ought to have been requested to refund the money, and not the last-named Committee.

The Steyning Water Company's Provisional Order.—Major Marindin has reported upon the inquiry which he lately held respecting the application of the Steyning Water Company for a Provisional Order to obtain water from the Shoreham and District Water Company's works. In the course of the report, he says: "This is a case presenting very unusual, if not unprecedented features; for although technically certain undertakers seek for powers to supply water in Steyning, the scheme is virtually one for the extension of the district of the Shoreham and District Water-Works Company, from whom the undertakers have agreed to obtain their supply of water. After a consideration of the arguments and evidence, I have no hesitation in arriving at the conclusion: (1) That it would be to the advantage of the parish of Steyning to obtain the water in the manner proposed. (2) That the Shoreham and District Water-Works Company are in a position to afford this supply, without in the slightest degree affecting prejudicially the supply in their own district; and it is apparent that the objections lodged are almost entirely on account of the manner in which the Company are fulfilling their obligations to the inhabitants of their own district, and not against the powers sought by the undertakers to supply Steyning. As to these objections, I may say, though it is really a matter somewhat outside the scope of my inquiry, that I consider it is most desirable that the Shoreham and District Water-Works Company should, as soon as possible, provide some means for direct communication between their works and Portslade reservoir, so as to ensure that a proper head of water is always maintained in their reservoir, and that they should replace with large mains all the mains in New Shoreham which are not capable of bearing the pressure of the high-level reservoir under any circumstances. This Company, it was admitted, is not only paying the full dividend, but a bonus on account of past deficient dividends, bringing the total amount paid up to 16 per cent., so that it is in a position to spend money; and it would have been far more satisfactory if they had sought for an extension of their district in the usual manner. On the merits of the case, however, I can recommend that the Order applied for by the undertakers for Steyning shall be granted; but subject to some modification as to the price and capital, and the arrangements with the Shoreham and District Company, and subject also to a legal decision that the Shoreham and District Company would be within their powers in supplying water for Steyning." The Steyning Rural Sanitary Authority have, since the issue of this report, sent a letter to the Board of Trade, calling their attention to the fact that, by the Provisional Order as now drawn, the Shoreham and District Water Company are given further powers; and protesting against these powers being given unless an inquiry is held into the present supply in the Company's district.

MISCELLANEOUS NEWS.

GAS UNDERTAKINGS IN THE COLONIES.

We have lately received the reports and accounts of a few colonia gas undertakings, from which we take the following particulars :—

The profit made by the Australian Gaslight Company in the six months ending Dec. 31 last was £54,765. Adding £2820 brought forward, the amount available for distribution among the proprietors was £57,585. The Directors recommended a dividend of 9s. per share upon the old shares, and a proportionate amount on all the new shares upon which the last instalment had been paid. This would absorb £51,129, and leave £6455 to be carried forward. The Engineer (Mr. T. J. Bush) reported favourably upon the condition of the Company's plant. With the view of extending the public knowledge of the uses of gas, the Directors arranged for the delivery, during the period covered by the report, of a number of cookery lectures in the various suburbs of Sydney ; and they have encouraged consumption by making a further reduction of 3d. per 1000 cubic feet in the price of gas as from the beginning of the present year. This concession will apply to the gas used for the public lighting.

No feature of importance marked the business of the Brisbane Gas Company in the half year ending on Dec. 31 last ; the general economy in public and private circles still affecting the consumption of gas. The sales produced £18,828 ; and there was a balance of £11,573 on the profit and loss account. The Directors recommended the payment of a dividend of 5 per cent., amounting to £6995 ; and the writing off of a further sum of £4000 on the Petrie's Bight property.

The Launceston (Tasmania) Gas Company, like other undertakings in the Colonies, felt the effect of the continuous commercial depression in the second half of the past year. Economy in the consumption of gas was studied by the consumers generally, with the result that there was a loss of revenue from sales by meter to the extent of £508, as compared with the corresponding period of 1892 ; while the cost of coal was increased by £209. The material supplied was, however, of excellent quality ; and the illuminating power of the gas was maintained considerably above the standard. The last reduction in price —from 7s. 1d. to 6s. 8d. per 1000 cubic feet—was unfortunately made just before the financial crisis ; and since then the sales of gas have fallen off, instead of increasing as expected, while heavy additional charges for duty and wharfage have been imposed on coal. The Directors, however, have decided to continue the supply of gas for the present at the reduced rate—believing that the business of the Company will thereby be extended, and their best interests promoted. The amount standing to the credit of the profit and loss account at the close of the year was £2722 ; and out of this sum an interim dividend of 4 per cent. has been declared. Under the supervision of the Engineer (Mr. T. S. Cleminshaw), the works carbonized 2451 tons 15 cwt. of Newcastle coal and 114 tons 15 cwt. 3 qrs. of shale ; the quantity of gas produced being 26,011,100 cubic feet, or 10,135 cubic feet per ton, of an average of 19·07-candle power. The gas unaccounted for last year amounted to only 4·99 per cent.

The Maryborough (Queensland) Gas Company reduced the price of gas from 10s. to 8s. 9d. per 1000 cubic feet early in the six months ending Dec. 31 last ; and though this concession gave great satisfaction to the consumers, it unfortunately did not result in increased consumption, owing, as the Directors believe, to the continued depression in trade. An effort to stimulate business was made by forming cookery classes ; and they were reported to have been fairly successful. Heavy expenditure was incurred in the past half year in rebuilding a bench of retorts and carrying out other reparations of the works, necessitated through the damage done to them by the floods early in the year. They are stated to be now practically as good as new ; and the plant and appliances generally are in an efficient condition. With the unappropriated balance added, the profit was £936 ; the net amount available for distribution being £899. The Directors recommended the declaration of a dividend at the rate of 6 per cent. per annum, which would absorb £750, and leave £149 to the good.

The Napier (N.Z.) Gas Company realized £9494 by the sale of gas in the year ending Dec. 31 last ; and at the close there was a balance of £2029 to the credit of the profit and loss account. The quantity of gas sold was 2,700,000 cubic feet, of which 600,000 cubic feet was used in stoves. In regard to the works, the retort power was increased by the erection of three additional settings, with all the latest improvements. A reduction in the price of gas was made in October ; and the Directors hope to be able to make a similar concession during the current year. At the recent annual meeting, an interim dividend at the rate of 10 per cent. per annum was paid for the first six months of the year ; and a final dividend was declared at the same rate for the remainder—leaving a balance of £54.

The Rockhampton Gas Company is an undertaking which has peculiar interest, insomuch as there is associated with it an electric lighting business. Notwithstanding the general depression in the district, necessitating the exercise of economy on the part of the consumers of both gas and electric light, the profit realized in the latter half of the past year was greater than in the corresponding period of 1892. This satisfactory state of things, however, must be attributed to the older portion of the concern ; the gas business returning a sum of £2006. The electric lighting operations resulted in a loss of £21 ; and this amount added to the interest (£294) on the capital invested in the plant and buildings, made a debit balance of £315. The net profit from the whole of the business was £1691. An installation of arc lamps has been put up on Fitzroy Bridge ; and applications are coming in from business people for similar lamps for outside illumination. The retention of the power to supply Rockhampton with the electric light is dependent upon the Company commencing operations and installing the light to the satisfaction of the Governor in Council, as well as of the Municipal Council, within five years from the date of the Act authorizing the supply. His Excellency has now intimated his approval of the work done by the Company in this direction ; and the Council have passed a special resolution to the effect that they are entirely satisfied with the manner in which the light has been installed. This being the case, the Company's powers in respect of electric lighting are finally confirmed. The Directors have had under consideration the debit balance on the electric lighting account ; and they have come to the conclusion that it can be fairly written off the general reserve fund. At the recent half-yearly meeting, they recommended a dividend at the rate of 10 per cent. per annum, which amounted to £1997. The Company's Secretary and Manager is Mr. W. Spier.

Stimulated, no doubt, by a reduction in price, which came into operation on the 1st of July last, and assisted by the extensive adoption of gas for cooking and heating purposes, there was a substantial increase in the quantity of gas consumed at Wellington (N.Z.) in the past year. The working account, which shows the results achieved by the Engineer and Manager (Mr. H. P. Higginson, M.Inst.C.E.), gives evidence of considerable economy having been effected by the new purifying plant, which was brought into use early in the year. In the twelve months, new mains to the extent of more than a mile were laid, and 159 new services fixed. The balance to the credit of the profit and loss account at the close of the year was £6122 ; and this has been disposed of by paying a final dividend of 5½ per cent. (making 11 per cent. for the year), writing £2000 off the cost of plant, and carrying forward £1722.

"IRREGULARITIES" IN THE SOUTHPORT CORPORATION GAS DEPARTMENT.

At the Meeting of the Southport Town Council last Tuesday, a letter was read from Mr. Baxter (one of the members), drawing attention to the irregular way in which the books of the Gas Committee were kept —more especially those at the Crowlands and Eastbank Street offices. He suggested that a qualified accountant should be called in, to go through the whole of the irregularities that had taken place. Alderman Fisher thought it would not be necessary to call in an outside accountant, because the accountant in their own offices could do all that was required. Mr. Hough supported the proposition that an independent man should be called in, because their own servants were, he said, to a certain extent bound down. After further discussion, the matter was referred back to the Gas Committee for their consideration. Alderman Hacking then moved the adoption of the Gas Committee's minutes, which included the following paragraph referring to irregularities committed by the Gas Manager (Mr. J. Booth) : "The Gas Manager presented a statement of all moneys irregularly received, and of all unauthorized payments made by him. The Committee examined the said statement, and were satisfied that, while the Gas Manager had committed irregularities, there had been no dishonesty on his part in dealing with the moneys of the Corporation, and that the same had all been applied for Corporation purposes. It was resolved that the Committee, whilst absolving Mr. Booth of dishonest intention, consider that, in committing the irregularities in question, he has abused the confidence reposed in him by the Committee." Mr. Boocock having seconded the motion, Mr. Threlfall moved, as an amendment, that the matter be referred back to the Committee with instructions to call upon the Manager to resign. This was seconded by Mr. Holland ; but on a vote being taken, the amendment was lost by 15 votes to 20. A further amendment that all the books relating to the matter should be placed in the hands of the Corporation Auditors for further scrutiny was also lost ; and the original resolution was then carried.

A NEW GASHOLDER FOR MIDDLESBROUGH.

The Wire-Rope System of Guiding Adopted.

The members of the Middlesbrough Town Council had under consideration last Tuesday the question of constructing a new holder on the Marshes. The Gas Committee recommended that the tender of the Whessoe Foundry Company, Limited, should be accepted ; but it appeared that a Sub-Committee had previously recommended the acceptance of a tender submitted by Messrs. Ashmore, Benson, Pease, and Co., subject to satisfactory arrangements being made as to the terms and form of the holder. The adoption of the Gas Committee's recommendation having been formally moved and seconded, Alderman Hugh Bell moved, as an amendment, that the original recommendation of the Sub-Committee be adopted. He stated that four firms had tendered ; and it was found that the offer of Messrs. Ashmore, Benson, Pease, and Co. was the lowest by £900 ; but that it was for a special form of holder known as Pease's wire-rope patent, for which the price was £14,401. The next lowest tender sent in was that of the Whessoe Foundry Company for £15,368. Messrs. Ashmore, Benson, Pease, and Co. were one of the largest and best known firms of gas engineers in the country, having built what until lately was the largest gasholder in the world. They had contracted for the South Metropolitan Gas Company ; and they had applied their patent to one of the gasholders of the Manchester Corporation, giving a guarantee of the efficiency of the work. If the same firm would give a similar guarantee to Middlesbrough, he thought it would be throwing the ratepayers' money away to go past them. Mr. Watson seconded the amendment. Alderman Bulmer thought the Corporation could not afford to experiment in this way ; and he considered it would be practically impossible to stay a holder by the wire-rope method so that it would be safe. Other members spoke in support of the amendment ; but Alderman J. F. Wilson was of opinion that the proper course would be to refer the matter back to the Gas Committee for further investigation, and, it might be, to obtain outside advice. Alderman Archibald remarked that they were asked to enter upon an experiment with the wire-rope system on a scale to which it had never been tried anywhere else in the country. It was because they had had so many unhappy experiments in the past, that he hoped they would go in for the old and well-tried principle of column guides. Colonel Sadler said he had seen the new system in use at Manchester ; and he was told by the Engineer that, during the terrific gales of last year, the holder behaved magnificently, and much better than the holders with columns. The Mayor (Mr. T. Baker) hoped that the whole matter would be referred

back to the Committee for further consideration. On being put to the vote, Alderman Bell's amendment was carried by 15 votes to 13. A further amendment referring the matter back to the Committee was moved; but Alderman Bell deprecated this course, and read a letter from Messrs. Ashmore, Benson, Pease, and Co. offering to indemnify the Corporation in the event of the new system not proving satisfactory. This amendment was rejected by 15 votes to 14; and finally Alderman Bell's motion was adopted.

THE MANAGEMENT OF THE STOKE GAS-WORKS.

Last Tuesday, Mr. Geen, who has taken a prominent part in the proceedings in connection with the management of the Stoke Gas-Works which have led to the resignation of Mr. Herman Taplay, was entertained by three of his colleagues on the Stoke Town Council at a complimentary dinner, given in the Magistrates' Room, at the Town Hall. The object of the gathering, to which 85 other ratepayers were invited, was to afford Mr. Geen the opportunity of fully expressing the view of the majority of the Council upon the gas question, and of replying to certain adverse criticisms thereon. The Deputy-Mayor (Alderman Baddeley) presided; and, after the usual loyal and other toasts had been honoured, he proposed "The Health of Councillor Geen," which was drunk with enthusiasm. In responding, Mr. Geen expressed his thanks for the cordiality with which the toast had been received, and entered at considerable length into the subject which had brought the company together. Referring to the attack made upon the Mayor for not calling a public meeting on the gas question when requisitioned to do so, he said he believed that not only had the Mayor good grounds for declining to convene the meeting, but he had a precedent which had been set by his predecessor, Mr. Alderman Kirkham, who had a petition presented to him in October last, and did not comply with its request. He justified his Worship's opposition to what he characterized as the extravagant and hare-brained schemes of the then Gas Committee, and said he believed he acted from conscientious motives. One of these schemes was the erection of new gas-works, which would have entailed considerable expenditure, and been a heavy burden upon the ratepayers for some time to come. Another was the oxygen process of purification, the adoption of which had not produced the financial results promised. The Mayor's opposition to these schemes was, in his opinion, genuine, real, and honest; and it was not, as had been stated, the result of "viciousness." Coming to the action of the present Gas Committee, he said it must be borne in mind that the Committee was practically an executive one. There were various matters connected with it, such as buying and selling, which were excluded from the survey of the Council as a whole; consequently, the men composing the Committee were, above all others, best capable of dealing with the gas question upon its merits. But in order to be conversant with the doings of the Committee, regular and systematic attendance at the meetings was necessary. Two of the members who were not in agreement with their colleagues in their recent action, did not give the time or the consideration to the business that the others did; and therefore they could not expect to dictate to the Committee. But it might be said that the Committee now stood as two to one in favour of the course followed by the Council. It had been asserted that there had been no charges brought against the late Manager. Certainly, a charge was made that the management was not giving satisfaction. If none had been made, why was a Sub-Committee appointed to investigate the matter? The report of the Sub-Committee was to the effect that sufficient personal supervision had not been given to the management of the works. Mr. Geen then went on to compare the present results with those obtained previously; and he stated that in the financial year commencing with the current month they would save by the new arrangements entered into upwards of £300 a year in salaries—not by cutting down, but by reducing surplus hands. It was absolutely impossible for the concern to go on well if they had to pay considerably higher than other undertakings for management and general expenditure. It was from this standpoint that he wished the recent action of the Committee to be judged. There was one other matter. It had been regarded by the late Manager as an insult that the Committee had called in a working man to test the coal. Well, the Committee had confidence in him; for they might be sure that, unless they had it, they would not have put a man into such a position. He concluded by assuring the company that, as long as he had the honour to represent them upon the Council, he would always endeavour to discharge his duties to the best of his ability. Other toasts followed; and the proceedings were then brought to a close.

We cannot do better than append to the foregoing, the following remarks of the *Staffordshire Evening Post* last Wednesday: "Both parties having thoroughly aired their views, on the Town Council and in public, concerning the unfortunate dismissal of the Stoke Gas-Works Manager, we hope the matter will be allowed to rest. It has been a most unpleasant incident, which has divided the Stoke Corporation more than any other question; and it has given rise to acrid discussion and bitter recrimination. So far as we can see, no possible good can come of a continued struggle; but, on the other hand, we are all painfully aware of the injurious effect on public life such unpleasant incidents often have. The Stoke Corporation were at one time noted for the quietude, courtesy, and good order always prevailing at their Council meetings; and we trust that, in the best interests of Stoke public life and corporate unity, the hatchet will now be buried."

Completion of New Gas-Works at Runcorn.—The new works which have been constructed by the Runcorn Gas Company on the banks of the Bridgewater Canal are now complete, and the manufacture of gas was commenced there last Saturday week. The erection of the works has occupied two years; and they have been carried out under the personal superintendence of the Manager (Mr. J. R. Frith). The cost has been greatly reduced through Mr. Frith making on the ground all the bricks required.

THE GRAVITATION WATER SCHEME FOR CARLISLE.

The Committee's Report Withdrawn.

The members of the Carlisle Town Council resumed consideration of the report of the Water Committee upon the above subject at their meeting on the 3rd inst. (see *ante*, p. 536, 620). The Town Clerk opened the proceedings by reading the resolution which was recently passed by a Town's meeting; also a resolution passed by the millowners on the Caldew near Carlisle, to the effect that no gravitation scheme would be satisfactory to them which did not guarantee a sufficient supply of reserve water, as provided for in Mr. Mansergh's first report. He also read a letter from Dr. Graham, enclosing resolutions which had been passed at a special meeting of the Carlisle Medical Society, to the effect that the River Eden, receiving as it did the sewage of several towns and many villages, was an undesirable and unsafe source of water supply; and that any scheme which would provide Carlisle with water from a source undoubtedly free from pollution was deserving of support as conducing to the health and safety of the community. The discussion was resumed by Mr. Etchells, who wondered how many thousands of pounds had been added to the estimate of the cost of the gravitation scheme by the millowners' resolution. He criticized the estimates which had been made as to the extent of the supply of water to be obtained from Mosedale, and remarked that Mr. Mansergh's observation that he was "inclined to think" that 2 million gallons per day might at all times be relied upon, showed the Committee proposed to take every drop of water to be found in Mosedale in the summer. He did not dispute the quality of the water; but there was no doubt they would have to buy up the goodwill of the various businesses affected by the scheme. He arrived, therefore, at the conclusion that no project other than the one which was to cost £213,000 would satisfy the millowners. Mr. Wheatley next urged the Council not to confine the city to a pumping scheme for all time, and went on to show that the River Eden was a source of danger under certain circumstances. However, he could not help thinking, with regard to the new scheme, that Mr. Mansergh had jumped somewhat hastily to his conclusions; and therefore he thought the matter required further investigation. Mr. Errington was surprised the Water Committee had not, after the expressions of opinion inside and outside the Council, withdrawn the scheme for further consideration. He protested against the action of the local medical men in condemning a water supply that had at all times passed through every test that had been applied to it; and he argued that, if they constructed their filters in accordance with the present scientific understanding of such things, they would have not only a pure but an absolutely safe water from the Eden. Mr. Balfour Browne had stated that he did not think, from what he had heard in consultation, that the interests on the Calder were of importance; but he (Mr. Errington) held they were important, and, in fact, the life and soul of the city. When, he also asked, Mr. Mansergh assumed that £110,000 would cover the cost of the scheme, including compensation, had he the resolution of the millowners before him? If not, he maintained that the estimate was utterly below the mark. Mr. Dixon believed that a moderate extension of the present works would supply every need; and Mr. Moss said he was convinced that the only satisfactory scheme was the £213,000 one, which, however, was too costly. Mr. Creighton stated that the Committee were quite willing to take the matter back for consideration. They sympathized with the gentlemen who had pointed out the difficulty of ascertaining the compensation to be paid to the millowners. That was a thing that struck them to commence with, and that was the reason Mr. Mansergh reported altogether on his first scheme. The Committee were always of opinion that the right way to deal with the question was to give water compensation. As they knew, Mr. Mansergh sent the Committee the report which had been referred to. They were to a large extent staggered by it; and they never intended to act upon it at all, nor did they either as a Committee or as individuals suggest to Mr. Mansergh that he should cut out the reservoir, and that they should pay the millowners compensation in money. That suggestion came absolutely from London. They never employed Mr. Balfour Browne; and they did not hear of him until Mr. Mansergh brought him in. They had been quoting Mr. Mansergh against the Committee; but the thing should be the other way. The Committee never suggested that compensation should be paid by money; and the suggestion of the smaller scheme came absolutely from Mr. Mansergh. The Committee had thought that Mr. Mansergh had shot his bolt, and that the thing was done with; but one day Mr. Hepworth met him (Mr. Creighton), and said he believed they were going to get the gravitation scheme after all. Then Mr. Hepworth produced a letter from Mr. Mansergh, who had seen Mr. Balfour Browne. The Committee had consulted Mr. Mansergh; they were bound to be guided by him; and therefore they had brought the matter before the Council. Mr. Forster, as the mover of the report, said that, seeing what had turned up now, owing to the millowners, the Committee were willing to withdraw the scheme. They had never been pledged to it; but they could have carried it no doubt, if it could have been done for £110,000. The report was subsequently formally withdrawn.

An Explanatory Report by Mr. Mansergh.

A further report from Mr. Mansergh has been circulated among the members of the Town Council. He says that it is quite clear from the remarks made at the Council meeting on the 6th ult., that the difference between Nos. 1 and 3 schemes has not been rightly appreciated by some of the members. He could not, he remarks, possibly stultify himself by putting the No. 1 and No. 3 schemes on the same platform, as he would have done by saying that for £90,000 they could get as sound a scheme as the one set out in his first report, which was to cost £213,000. The proposal he laid before the Council in January, 1893, was one which, if approved by the Council and ratepayers, could hardly have failed to receive the sanction of Parliament, because it was conceived on the lines which had been confirmed by numberless precedents during the last 30 or 40 years, and neither the riparian, manufacturing, nor fishing interests on the river could have successfully opposed it. In advising a gravitation scheme utilizing the head waters

of the Caldew, he was bound to formulate it on this unimpeachable basis; but having done this, and found how heavy the outlay would be, he embodied in his report (in order to save time) the alternative scheme for bringing the existing Eden works up to a modern standard of efficiency. After this explanation, it will be seen, Mr. Mansergh says, that the expressions of surprise at the facile way in which he dropped £123,000 out of his estimate, made by more than one of the speakers at the Council meeting, were quite meaningless. Again, he declares that it was not by reason of anything he learned from the stream gaugings taken last year that he was induced to suggest the No. 3 scheme. It was put to him by Mr. Hepworth whether he saw any reason to revise his report of the previous January, especially in respect of the estimated cost of the gravitation scheme; and, in reply, he stated that the only way to reduce the cost would be by cutting out the storeage reservoir at Mosedale, and paying compensation in money instead of in water. If the Council drop out the reservoir, and go to Parliament with a Bill which leaves the question of compensation to be settled under the 6th and 12th sections of the Water-Works Clauses Act, 1847, they accept two risks: First, the failure of the Bill; and, second, the chance of having (consequent on its passing) to pay heavy compensation in money. He adds that, as he adheres to the £213,000 estimate for the complete gravitation scheme No. 1, and the £90,000 for scheme No. 3, so he adheres to the £84,000 for the pumping scheme. While not withdrawing a word he has said about the Eden water, he has no hesitation in expressing his very decided preference for a supply obtained from the head of the Caldew, on the assumption (which in his opinion is not an unreasonable one) that the capital cost of the former would be £84,000, and of the latter £110,000, including compensation.

The Rating of the Crossness Sewage Works.—At the West Kent Quarter Sessions on the 5th inst., an appeal by the London County Council against the rating, by the Erith Local Board, of the Crossness Sewage Works came before the Court. Mr. Fooks, who appeared for the appellants, said similar appeals were heard at the preceding sessions; and it was agreed that the result should govern the present appeal. He therefore applied that the rating of the works in question might be reduced from £21,021 to £20,000. Mr. Maurice, for the respondents, consented; and judgment was entered accordingly—each party to pay their own costs.

The Leamington Corporation and the Gas-Works.—At the meeting of the Leamington Town Council yesterday week, the Sub-Committee who were appointed to confer with the Directors of the Gas Company as to the purchase of their works, reported that the Board offered to submit a proposal of 26 years' purchase to the shareholders, or to dispose of the property by arbitration. The Committee recommended the Council not to accept these terms. Alderman Wackrill, in moving the adoption of the report, pointed out the inadvisability of purchasing the works on the suggested terms, which involved a capital outlay of £132,600, while the total market value of the shares was £105,000. An amendment referring the matter back to the Committee for reconsideration was lost; and the motion was afterwards passed.

Extraordinary Occurrence at King's Cross.—The *Daily Chronicle* is responsible for the following story: "On the evening of Saturday, the 7th inst., a remarkable incident was witnessed in Hampden Street, King's Cross, which caused some feeling of alarm among those living in the immediate neighbourhood. At half-past seven, a portion of the roadway, about three yards square, gave forth what appeared to be innumerable electric flashes of a very vivid character; these being accompanied by a crackling noise as of burning wood. The strange sight soon attracted an immense crowd; and it required all the efforts of a large body of police to keep the people at a safe distance from the illuminated spot—it being feared that serious consequences might ensue to any person approaching too near. A porter employed at the Hampden Club, who was the first to notice the phenomenon, at once went to the electricl ight office of the St. Pancras Vestry, and gave information; but the officials who visited the spot decided that the flashes were not duet o the presence of their main, which runs on one side of the street. The officials of The Gaslight and Coke Company were then communicated with, as their main runs on the other side of the street, and a gang of men were speedily sent to Hampden Street. Before the men reached the main, however, the officials came to the conclusion that the flashes were not caused by any escape of gas; and the hole already made was filled in again. The flashes, which were brilliant for an hour, continued more or less for nearly two hours."

The Water-Works Purchase Question at Worksop.—A largely-attended meeting of the ratepayers of Worksop, specially convened by the Local Board, was held last Tuesday for the purpose of testing, as far as possible, the feeling of the ratepayers as to the advisability or otherwise of the Board purchasing the local water undertaking. The Chairman (Mr. J. White) informed the meeting that the Board had power to purchase the works with or without the consent of the ratepayers; but they did not wish to do so before consulting them. He therefore moved a resolution approving of the purchase. Nearly all the speakers who followed were opposed to the proposition. Mr. Tylden Wright, J.P., submitted that this was entirely the wrong time to bring forward the question; and he knew the Company's supply was very uncertain. Replying to inquiries, the Clerk stated that the capital of the Company was £19,612. The income last year amounted to £1715; and the expenditure, to £890; the balance carried forward being £825. The dividend was about 4½ per cent. Mr. D. Hoult said he had no doubt the Company was a paying concern. If they purchased, the price would probably be about £22,000 or £23,000; and he believed the transaction would pay them. Mr. Wing said it might be a paying concern now with the existing capital of £19,000; but if they purchased at (say) £25,000, would it, he asked, pay on that capital, especially if they had new mains to put down at their own expense? Several other gentlemen expressed their views on the subject; and, on the Chairman putting the matter to the vote, only one hand was held up for the resolution. With this exception, the meeting was unanimously of opinion that it was undesirable to purchase the works.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

This week, of course, the first place must be given to the "informal" meeting of gas managers, which was held at Glasgow on Wednesday. Mr. M'Gilchrist, of Dumbarton, has good reason to be proud of the result of his efforts to bring the gas managers of Scotland together, to have a talk over matters affecting their working during the past winter. Year by year the informal meeting is growing in importance. There is a charm in the very nature of the meeting, which, in sporting phrase, may be termed a sort of "go-as-you-please" one. But, of course, the real secret of the success of the gathering lies not altogether in its freedom from the trammels of regulations and bye-laws, and the absence of formal business, but is largely the result of the personality of Mr. M'Gilchrist, who may be regarded as the father of the movement. It is questionable whether, without his careful and plentiful provision for it, it would long survive. It is difficult for gas managers, when he presents his bill of fare, and adds to it his own personal geniality, to resist accepting the invitation. With all this, however, I cannot help feeling that I was right when I wrote formerly that I considered it would be advisable to place the meeting under the wing of the North British Association. So long as Mr. M'Gilchrist is prepared to go on as he has been doing, there is no need for a change. But he cannot go on always; and who is to succeed him? The informal form of the meeting it would be advisable to retain, for it is an advantage—or at least a relief—to get free at times from the practice of reading formal papers, and to get the opinions of people upon current topics, spoken straight out without preparation. Such a form of meeting would not, however, do always, as was illustrated on Wednesday by the reluctance to give figures, particularly by Mr. Yuill, who felt himself restrained by the fact that he is to bring his subject before the North British meeting in July. The informal meeting therefore suffers through its being overshadowed by the North British meeting, which it would not do to the same extent were both gatherings held under the same auspices. Turning to the meeting itself, I suppose the large attendance was due, in great measure, to the prospect of seeing the Lowe water-gas plant at Dawsholm. On that point, there seemed to be a good deal of misunderstanding. Many gentlemen went there expecting to see the process permanently adopted as part of the gas undertaking of the Glasgow Corporation; and they were disappointed to find only a small experimental plant. This, coupled with the fact that figures as to the cost of working could not be given (as, in the circumstances, it was quite proper that they should not), led to the retaining of an open mind on the subject of enrichment on the part of many who went in the expectation that they would see something convincing. The question of enrichment is at present so full of processes, that the ordinary gas manager is apt to get bewildered; but of this more afterwards. As regards the other sights at Dawsholm, it will be conceded by all that nothing more striking was seen than the Arrol-Foulis charging and drawing machines. Whatever process of enrichment may be adopted by a gas manager, he will, as far as human foresight can penetrate the future, always require to fill retorts with coal and empty them; and everything which will enable that work to be done more economically than by the existing methods, is sure to command attention. There is no mistake that the Arrol-Foulis machines fulfil that condition; and they are certain to find a place among the list of mechanical stokers in the market. It must have been a revelation to many to see a huge retort-house, containing over 500 retorts, being worked with a staff of men of whom not more than a dozen were visible, and those doing what was but child's play compared with what managers are accustomed to see their own men engaged in at home. When the station is completed, it will stand as one of the best equipped in the United Kingdom. Mr. Foulis, the Engineer, deserves to be congratulated upon the manner in which he has been able to get his Corporation to lead the way in the matter of introducing machinery which saves both labour and cost. I should say it was a large responsibility, and must have required some nerve, to recommend the large outlay which was necessary; and it speaks volumes for the confidence which the Corporation have in Mr. Foulis that they accepted his recommendations, and gave him a free hand to go on with his reforms.

To return to the meeting, it may be said that only three matters were discussed at it—the Yeadon retort, water gas, and oil gas. The President did not overload his address with subjects, nor detain the meeting long, for both of which he is to be commended. He grasped the fact that it was enrichment which was uppermost in the minds of his fellow managers; and he directed their attention chiefly to that Neither of the questions discussed, it must be said, was done justice to—that is, from the point of view of the manager who went to the meeting to learn something that would enable him to make up his mind as to which process he was to adopt—on account of each of the gentlemen who were called upon to speak to them holding back results. Each of the gentlemen was quite confident as to the advantage of his own system; but that goes for little to a manager when he comes to the point of advising his Directors or Committee as to the process to be adopted. I suppose there is coming, in the near future, a sort of close-quarters conflict among enrichment processes; and that the advocates of neither care to say very much in the meantime as to what is being accomplished by their plant, until fuller testings show what they are capable of doing, lest they should in any way give themselves away to the enemy. Perhaps the surprise of the meeting was Mr. Nelson's statements regarding the Yeadon retort. Mr. Nelson is well known to be an enthusiastic supporter of whatever he takes up. On the subject of the Yeadon retort, his enthusiasm knows no bounds. It is unfortunate that he was unable to give more than his own assertion that the retort was working wonders. If, as Mr. Mitchell, of Edinburgh, said, Mr. Nelson's statements are correct, the Yeadon process will outstrip all others; for it will be an enriching process in which not only coal, but also material which has hitherto been refuse may be used to advantage, and it not only enriches the gas from coal without any admixture, but it increases the bulk. Further, it will not only give results which are equal, if not superior to those which can be got from oil or water gas enrichment, but it

will be as serviceable as water-gas plant in the matters of the wondrous volume of output and the expedition with which it can be brought into use—upon both of which qualities oil-gas processes will be unable to compare with it. This is a large order which Mr. Nelson asks to be accepted; and he must not complain of a good deal of scepticism as to his results until he is prepared to substantiate them. This he must be able to do soon, or he may find himself forestalled by other processes. Perhaps it is to prevent this that he is so eager to push the Yeadon retort forward, before it has been fully tested. Whatever Mr. Nelson's reason, his word as to the merits of the invention cannot be set aside without proof; and there is therefore necessity for gas managers for some time keeping an open mind on all enrichment processes.

As for the Lowe water-gas process, Mr. Glasgow was very courteous in his reception of the gentlemen at Dawsholm, and very frank with them in the meeting; but he was under the disability that his employment by the Glasgow Corporation prohibited him from going into results. He preferred to tell them what he was doing at Belfast; and the few figures he gave conveyed some indication of the capabilities of his process, in the matter of production. The other results—enrichment and cost—must be waited for; and again there must be an open mind.

The only oil-gas process spoken to was the Peebles. It seems to be almost common consent that it should be put in the first place among oil-gas systems, which is only what those who are acquainted with it would expect. The process is in a position of advantage over all others, in that it has already been brought into practical and permanent use in a considerable number of gas-works, and is therefore nearer the time than the others when an authoritative announcement may be made of what it is capable of doing in the matter of saving cost as well as of enrichment. The July meeting of the North British Association should give the opportunity for something convincing being said; and in this case, too, there is the necessity for keeping an open mind on the subject, at least till then. It perhaps should be explained that probably more information would have been given to the meeting had either of the inventors been present; but they were unfortunately detained at home by a deputation who were that day visiting Peebles to see the oil-gas plant.

The deputation from the Paisley Gas Commissioners who recently visited Perth, to inspect the Peebles oil-gas process in use there, reported to the Commissioners this week that every facility was afforded them for seeing the process in operation and ascertaining results. The views of the Committee, so far as they had been able to form an opinion, were satisfactory. The remit to the Works Committee was continued, in order that further inquiry may be made.

The output of gas at Perth during the past month showed an increase of 132,500 cubic feet, as compared with the corresponding month of last year. After deducting the gas made from oil from the total quantity produced, the yield from coal was 9788 cubic feet per ton. Both these results were satisfactory, when it is considered that with oil there is a decreased consumption of gas, owing to its increased illuminating power, and that when oil is used an inferior class of coal is carbonized.

The Portobello Police Commission on Monday had before them a report by the Special Committee they some time ago appointed to consider as to the lighting of the burgh. The Committee reported that they had communicated with the Portobello Gas Company, asking a reduction of the charge for public lighting. They had received a reply to the effect that last year the Directors contemplated making a reduction, but that, owing to the coal strike, the cost of producing gas was raised fully 20 per cent.; and they were therefore unable to make the expected reduction. The Company were willing, if the community desired it, to reduce the illuminating power of the gas to 24 candles; and then they would be able to lower the price. The Company also submitted that the burgh received terms for public lighting which were most liberal, considering that the gas supplied is of higher illuminating power than in any other burgh in the country. These latter statements the Committee of the Police Commissioners disputed. They also stated that they had found electricity to be too expensive to recommend. With reference to the application to the Edinburgh and Leith Gas Commission for a supply of gas, they stated that the Edinburgh Commissioners found a difficulty in giving better terms to Portobello, in respect that there was a Gas Company in Portobello, and that in 1888 the Police Commissioners of Portobello petitioned Parliament to exclude the burgh from the operation of the Edinburgh and Leith Gas Act. The application to Edinburgh has therefore apparently fallen through. What the Committee recommended was the erection of a photometer, for the use of the Burgh Analyst, in the Municipal Buildings; and that a portion of the town should be lighted by Peebles governor-burners. The report is to be discussed a month hence. It would appear as if the Police Commissioners are climbing down in the matter of their complaints regarding the Company's gas.

The Ayr Town Council are about to make a splash in the matter of electric lighting. On Monday last they had a report by the Burgh Surveyor on the subject, which was a very full document, and was, as usual, of a glowing nature. The Surveyor, comparing the cost of electric with that of gas lighting, has arrived at the conclusion that an 8-candle power electric lamp with electricity at 6d. per unit, costs 6s. 10d. a year of 500 hours, as compared with 6s. 3d. for Ayr gas at 4s. 2d. per 1000 cubic feet; and that a 16-candle power electric lamp costs 12s. 10d., as compared with 8s. 4d. for gas. He recommends an expenditure of £11,000 upon a high-tension electric lighting installation; and in a hypothetical way calculates that upon this sum and the cost of working, there would be a charge of £1641, and a revenue of £1650 annually. I am only concerned with this to say that in his estimate of expenditure, the Surveyor leaves depreciation altogether out of account, which would add nearly £1000 more to the £1641, and would convert a prospective balance of profit of £9 a year into a deficit of £991. Similarly, he recommends that 95 gas-lamps should be replaced by 15 arc lights. The former cost about £200 a year, and the latter are estimated to cost £300; but, as stated at the meeting, they are expected to yield fifteen times more light than the gas-lamps. That calculation is based on the assumption that 2000-candle power is to be got from each lamp, which is absurd. If 900 candles be taken, the light would be five times that of gas; but then there is to be taken into account that it is proposed to remove more than six gas-lamps to make way for one arc lamp, which would be a starving of the public lighting. The usual rule is to place one arc lamp for every three gas-lamps; and, calculated in this way, there would be, on the basis of 15 lamps, only two-and-a-half times the light from arc lamps more than there is at present. The Corporation have resolved to call in Mr. Robert Hammond to advise them. His report will be interesting reading.

Mr. Strachan, a Town Councillor of Montrose, has, like Mr. Preece, discovered that electric lighting is the poor man's light. He and some of his colleagues have been on deputation to inspect electric lighting plant; and they returned home in ecstasies over the installation at Coatbridge, which, by the way, was only opened a fortnight ago, and which, notwithstanding puffs by Lord Kelvin and others, is so little appreciated at home that, I am told, less than a dozen people use it. Mr. Strachan, taking the price of electric lighting at Coatbridge at 5d. per unit, and forgetting for the time that in Montrose they could not, on account of the extra cost of carriage, sell current at so low a price, makes himself believe that the comparison is 3s. for electricity and 4s. 7d. for gas. I do not know how he works out his equations; but I calculate a 4-foot per hour lamp at Montrose to cost 9s. 2d. a year, and a 16-candle electric lamp, which will give one-fourth less light, 12s. 6d. a year. It would not strike the average poor man that this was particularly the light for him; and, truth to tell, the conviction that it is so does not seem to be very deep among the members of the Montrose Police Commission, for they resolved that, before they do anything further in the matter, they should, each and all of them, visit Coatbridge and inspect the plant there.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *April* 14.

Sulphate of Ammonia.—The market remains inanimate; and the statistics to the end of March fairly explain the reason. It appears from these that the shipments for the three first months of the year are considerably behind those of 1893—viz., about 6000 tons; and although Germany has taken more, the deficiencies, especially as regards America and France, are most marked. The strangest part of the business is that there are no stocks pressing on the market which might have been expected from the statistical figures; and the declining prices seem entirely due to the sales of speculators, deliberately made to reach a lower level of values. Of course, if high prices have in many instances been instrumental in reducing consumption, and if a corresponding reduction were to go on while present rates remain in vogue, then "bear" operations are not without reason. But this contingency is by no means assured, and the simultaneous result of the prevailing bright weather and bad trade generally may, in all probability, considerably curtail the production. Quotations are generally a little below £13 10s. now; but the amount of business is small, and many makers have withdrawn from the market. Nitrate meanwhile meets with a large sale; the dry weather favouring its consumption. Owing to present scarcity, prices are now at 10s. 9d. per cwt.; thus bringing the difference between the two commodities to an almost normal level.

LONDON, *April* 14.

Tar Products.—90's benzols do not improve; but 50's are in better demand, and the forward price is a shade better. Several large contracts for creosote are on the market; and these, together with the falling off in production, tend to stiffen the price considerably. Carbolic acid is more freely offered; and there seems every probability of the price improving. Solvent naphtha is very firm, and seems unusually scarce. The Committee's price for anthracene is being fully maintained. Pitch has ceased to drop; and the position for forward business is considerably better, notwithstanding the temporary stoppage of supplies for Swansea owing to the strike. The following prices have been paid for business during the week: Tar, 12s. 6d. to 17s. Pitch, 26s. to 27s. 6d. Benzols, 90's, 1s. 2d.; 50's, 1s. 5d. Creosote, 1¼d. Creosote salts, 25s. Solvent naphtha, 1s. 2½d. Toluol, 1s. 8d. Cresol, 1s. Crude benzol naphtha, 30 per cent., 6d. Carbolic acid, 60's, 1s. 8d. Anthracene, "A," 1s. 2d.; "B," 11d.

Sulphate of Ammonia ranges at about the same price as last week—£13 10s. to £13 15s. The make is rapidly falling off, and there seems every probability of present price being maintained, if not improved upon. Nitrate of soda is steadily advancing. Gas liquor is quoted at 10s. to 12s. 6d. per ton.

The Accounts of the Stockton and Middlesbrough Water Board.—The Stockton and Middlesbrough Water Board had before them last week the accounts for the six months ending Feb. 14 last. They showed that the capital expenditure for that period was £39,756; bringing up the total cost of the undertaking to £1,651,862. The principal items of capital expenditure were: Hury reservoir, £1301; Blackton reservoir, £4310; flood-water channel, £13,051; conduits Nos. 2, 3, and 4 (gravitation main), £17,250; Engineer's commission, £2000; and extension of supply mains, £751. The sums received on capital account in the half year amounted to £84,000; making the total £1,670,438. The revenue for the half year was £31,673; so that the loss of income from the Kirkleatham district was nearly balanced by increases in other directions. The expenditure on revenue account amounted to £8435. The net revenue account was debited with several items; among them being a sum of £1681 on account of the appeal following the Kirkleatham arbitration. There remained a balance of £53,807; and of this £45,000 had been paid to the constituent Corporations during the half year. The gravitation scheme, it was stated, continued to make satisfactory progress; and the Board had no reason to doubt that the Balder water would be supplied by the end of the current year.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—Steadily increasing depression is the report, so far as all descriptions of round coal are concerned. The demand for the better qualities is scarcely more than sufficient to take away about two days' per week production of the collieries; and where they are working four days, which represents about the full average, half the output is in most cases going into stock. Many of the pits, however, are not kept running more than about three days per week. In addition to the unsatisfactory outlook of trade as regards demand, there is an uneasy feeling generally as to the possibility of some further troubles in connection with wages. The miners are not at all satisfied with Lord Shand as Chairman of the Board of Conciliation; and they are determined that the question of a minimum wage, which he has struck out from the rules, shall be definitely settled, if they are to continue to be governed by the Board of Conciliation. It is not at all improbable, in view of the fact that trade is rapidly getting back into much the position it stood in prior to the stoppage last year, that coalowners will very shortly give notice of some reduction in wages; and this will have to come before the Board of Conciliation. If the men accept any reduction whatever, it will be on the condition that the minimum wage is at the same time settled; or it will only be temporarily acquiesced in until the twelve months for which the Board was elected has expired, when it is not at all unlikely they might themselves give notice for an advance in wages, or insist upon the minimum wage being settled, as the condition of continuing the Conciliation Board. As to prices, they are very irregular, owing to one or two large firms who are outside the Coal Sales Association having given way to a considerably larger extent than the official reductions of the Association. It is only in exceptional cases that best Wigan Arley coals are now fetching more than 11s. to 11s. 6d.; Pemberton four-feet and seconds Arley, 10s. to 10s. 6d.; the lower qualities of round coal, 8s. to 8s. 6d.; and steam and forge coals, for inland requirements, 7s. 6d. to 8s., and for shipment about 8s. 6d. to 9s. per ton, delivered at the Garston Docks or the High Level, Liverpool. With the present very small production of slack, there is a continued scarcity of engine fuel in the market; but in view of the very low figures at which inferior qualities of round coal and through-and-through coal can be bought, prices are not more than maintained at recent full rates. Burgy at the pit mouth averages 8s.; best qualities of slack, 6s. 6d. up to 7s.; and lower qualities, 5s. to 5s. 6d. per ton.

Northern Coal Trade.—There is a slight recovery in the coal trade, partly due to the opening of ports that have been closed during the winter, and partly to the desire of some consumers to accumulate stock, as the prospects of labour disputes ahead seem to be graver. Best Northumbrian steam coals are firmer; and the price of 10s. to 10s. 3d. per ton f.o.b. is more steadily adhered to, whilst the collieries are much better employed than they were a few weeks ago. Second-class steam is also more in demand, and is quoted about 1s. per ton below best steam. There is a strong demand for steam smalls, at about 4s. 9d. to 5s. per ton; but one or two collieries ask even higher prices. Durham gas coals for ordinary sales are quoted at from 7s. 3d. to 7s. 9d. per ton f.o.b.; but one producer asks 8s. per ton. Manufacturing coal is quiet, though there is a good demand for the shipbuilding yards. In blast furnace coke, there is a larger local consumption; but the exports are disappointingly small. The f.o.b. price varies from 13s. 6d. to 14s. 6d. In gas coke, the local production is now a rather low one, so that it is more readily taken up—more especially with a fair export; but some of the gas companies are again trying to stimulate the household consumption. The prices are unaltered.

Scotch Coal Trade.—The slight brightening of the outlook last week has not proved at all permanent. The few orders which came from Russia gave a promise which has not been fulfilled, as it is reported there are considerable stocks left in that country; and a drying up of the demand has already set in. Mediterranean orders, it is complained, are going mostly to English firms, who are underselling the Scotch. Ell coal, for export, continues most in demand; and steam coal is meeting with a slow sale. Splint and main are both plentiful; pans it is with difficulty that the quoted prices can be got. The quotation are: Main, 7s.; ell and splint, 8s.; and steam, 9s. to 9s. 3d. per ton f.o.b. Glasgow. Shipments for the week amounted to 142,396 tons—a decrease of 8108 tons as compared with the preceding week, but an increase of 14,372 over the corresponding week of last year, when the Baltic ports were very late in opening. For the year to date, the total shipments have been 1,819,067 tons—an increase of 310,008 tons as compared with the same period of last year.

The New Water-Works Loan for Bradford.—A fortnight ago, we reported that arrangements had been made by the Bradford Corporation for the creation and issue of £500,000 of debenture stock for water-works purposes, at 3 per cent. per annum, repayable at par in 1954. At the meeting of the Council last Tuesday, Alderman Hill stated that the matter had been settled. Tenders were received amounting to £1,063,700; the prices offered ranging from £100 11s. 6d. to £101 5s. per cent.—the average being £100 12s. 2d.

San Paulo Gas Company, Limited.—The report of the Directors of this Company for the half year ending Dec. 31 last states that the net profit was £11,089. From this amount the interest on the debentures has been paid; and, after writing off to exchange account the sum of £1700, being the estimated loss caused by the depreciation in value of the currency balances, taken at 10¼d. per milreis (the rate on Dec. 31), there remains a balance, added to £4518 brought forward, of £13,064. The Directors recommend that a dividend at the rate of 6 per cent. per annum be declared for the half year, tax free; that £3000 be placed to reserve; and that £2564 be carried forward. The business of the Company continues to make satisfactory progress. During the period covered by the report, 137 additional street-lamps were erected; and the number of private consumers increased by 348. The numbers on Dec. 31 last were respectively 1952 and 4662. The quantity of gas consumed showed an increase of 20 per cent. over that for the corresponding period of 1892.

Gibraltar Water Supply.—According to a telegram received through Reuter's Agency, the British authorities at Gibraltar having been in negotiation with the Spanish Government for the concession of a supply of drinkable water from Spanish territory, the Superior Council of War at Madrid has unanimously resolved to advise the Government to refuse the request of the British authorities, on the ground that it would be contrary to the provisions of the Treaty of Utrecht, and, in the event of war with Great Britain, would constitute an advantage to the enemies of Spain.

Exhibitions of Gas Appliances.—Under the auspices of the Heckmondwike Gas Company, an exhibition of gas cooking, heating, and lighting appliances was held in the Freemasons' Hall last week. The principal exhibitors were Messrs. Fletcher, Russell, and Co., Limited, and the usefulness of their goods was demonstrated by Mrs. H. M. Young. The same firm have been exhibiting at James's Hall, Ystrad; lectures on high-class cooking by gas being given by Mrs. F. J. Baynes.——An exhibition was also held by the Bishop Auckland Gas Company during the week; practical lectures being delivered each day by Miss Lewis, of Nottingham.——From the 27th to the 31st ult., Messrs. W. Parkinson and Co. held a successful gas exhibition in the Central Hall, Walsall; and they have held similar exhibitions at Handsworth and Small Heath. Miss Edith Sanderson gave cookery lectures to large audiences.——Under the auspices of the Radcliffe and Pilkington Gas Company, Messrs. Fletcher, Russell, and Co., Limited, and Messrs. J. Wright and Co., Limited, opened an exhibition of their appliances in the Co-operative Hall, Prestwich, yesterday. It will remain open till Friday; lectures being given each day by Miss Lewis. The exhibition will be under the supervision of Mr. J. Braddock, the Manager of the Gas Company.——The Carron Company, Falkirk, last week held an exhibition of gas-stoves, heaters, &c., in the Literary Institute, Edinburgh, at which Miss E. C. Dudgeon, of the Midland School of Cookery, was the lecturer and demonstrator.——Messrs. R. and A. Main, of Glasgow, held a similar exhibition in the Picture Gallery, Arbroath, on Monday, Tuesday, and Wednesday last week; and Miss R. Hunter gave practical lessons in cookery,

Sales of Shares.—At the Mart, Tokenhouse Yard, last Wednesday, Messrs. Fox and Bousfield sold by auction 100 fully-paid £10 shares in the *European Gas Company* at £22 to £22 10s. each, and some shares of similar value on which £7 10s. had been paid, at £15 10s. to £16 each. Also some £5 shares in the *Oriental Gas Company*, at £5 15s. to £6 apiece; and some £5 shares on which only £4 10s. had been paid, at £5 5s. each. Among the other stock sold on the same occasion were ordinary £5 shares in the *Malta and Mediterranean Gas Company*, at £4 10s. to £4 15s., and £5 preference shares at £7 each; ordinary stock in the *Continental Union Gas Company*, at £234 10s. to £236 5s.; and £20 shares in the *Monte Video Gas Company*, at £13.——On the same day, Mr. R. Mack offered for sale at Newcastle, £15,000 of new consolidated stock in the *Newcastle and Gateshead Gas Company*. Before inviting bids, the Auctioneer stated that, when this amount had been disposed of, the Company would only have power to issue an additional £3000 worth of stock. The prices had steadily risen since 1883, when the average was £160 per share, until last year, when the price was £185; and now the value was £192 10s. per share. The result of the sale was that prices were realized ranging from £188 5s. to £192 12s. 6d.; the total amount produced being £27,000.——At Scarborough a few days since, 34 £5 shares in the *Filey Water and Gas Company* were disposed of by auction at £7 12s. 6d. each.——A number of £20 "A," "C," and "E" shares in the *Northampton Gas Company* were recently sold by auction at £45 10s., £33, and £30 10s. respectively; and 100 £5 13s. 4d. "D" shares changed hands at £9 12s. 6d. and £9 7s. 6d.——At Arbroath, on the 7th inst., £22 8s. of gas stock of the *Arbroath Corporation* was offered for sale by auction at the price of £40 per £1 8s. of annuity, and was sold in one lot for £45 15s. Four shares of the *Montrose Gas Company* were sold last Friday for £50 each.

Further Complaints against the Electric Lighting Works at Morecambe.—The Morecambe Local Board had to listen, at their meeting last Tuesday, to a deputation of property owners and residents in the neighbourhood of the electric light generating station, who related a terrible tale of trouble. The spokesman said they had to complain, first of all, of the "stinks"—to use a plain English word—from the Electric Light Company's works. The cause of these was, as the deputation understood, the discharge into the air of the superfluous water gas used for driving the machinery. The houses were filled with the stench; and while it prevailed the enjoyment of "afternoon tea" was impossible. Visitors had written asking if the nuisance had been abated; and saying that, if it was not, they would not come to the same house again. It was unquestionable that the smell affected health and comfort; and he could not describe it better than by saying that, in comparison with it, rotten eggs would smell sweet. He proceeded to state that the effect of the gas upon the men employed at the works was that when they went into the streets they had to be walked about, and not left to themselves lest they should die. They could bring visitors as well as residents to prove that the nuisance was a very serious one; and the Local Board had power to suppress it. They did not wish to use hard words; but they most emphatically protested against the smell contaminating their houses. They had no personal animosity against the Company, but they wanted protection. Various cases in which complaints of the bad smells had been made having been mentioned, the Chairman (Mr. J. Lee) said the previous deputation had complained mostly of noise and vibration; and the Board certainly went to considerable trouble in order to secure a remedy. On that occasion, the Medical Officer prepared a long report, in the course of which he practically said there was no nuisance from bad smells. If they were prevailing now, the Board would only be too glad to send the Medical Officer to try and find them out; and if he reported that they were injurious to health, the Board would be glad to deal with them. They sympathized with the owners and occupiers. He personally knew plenty of cases where visitors had been driven from the houses in consequence of noise and vibration. But in this matter the owners and occupiers had the matter in their own hands; for they could combine and have a case tried. The Board would do their best with regard to the stench. It was eventually decided that the Medical Officer should be instructed to report thereon.

Improvements at the Bradford Corporation Gas-Works.—The Bradford Corporation Gas and Electricity Supply Committee have recommended the Council to accept the tender of Messrs. Clapham Bros., of Keighley, for the erection of one of their patent condensers at the Mill Street gas-works, for the sum of £735; and also to approve of a plan for the alteration of condensers at the same works, at an estimated cost of £400.

The Cost of Public Lighting in Leeds.—The estimate of expenditure on public lighting for the next twelve months came before the Lamp Committee of the Leeds Corporation last Wednesday. The estimate a year ago was £22,483; while the actual expenditure was £23,382. This year the Committee expect to spend £24,223, of which £16,678 is calculated to be for the gas consumed in the public lamps. If the Gas Committee should decide to reduce the price for public lighting purposes, from 2s. 4d. to 2s. 2d. per 1000 cubic feet, as they have been requested to do, the Lamp Committee will probably have a surplus at the end of the year, instead of the present deficit.

Macclesfield Corporation Gas Supply.—At the meeting of the Gas Committee of the Macclesfield Corporation on Monday last week, it was announced that the profit realized by the gas undertaking in the year ending the 25th ult. was £1486—being £1000 more than in the preceding twelve months. This result was achieved notwithstanding a loss of £200 through decreased consumption of gas owing to bad trade, the expenditure of a considerable amount of revenue on improvements, and meeting an extra charge of £150 for interest and redemption of loans, in consequence of additional capital having been raised during the year for extensions. It was decided to hand over £1200 to the district fund, and add the remainder to the maintenance fund. Considering that the Engineer (Mr. J. G. Newbigging) had the coal crisis to contend with, he must be congratulated on his excellent management.

The Withdrawal of the London County Council's Water Bill.—At the meeting of the London County Council last Tuesday, the Parliamentary Committee reported that since their last meeting the prospect of being able to proceed with the Council's Water Bill had been largely diminished by the debate on the second reading of the East London Water Bill and other Water Bills on the 5th inst. Having regard to observations which fell from members of the Government in the course of the debate as to the necessity of the Council promoting some more practical measure, they thought it quite useless to proceed with the present Bill; and they recommended that it be not further proceeded with. This was agreed to. In the House of Commons last Thursday, Dr. Farquharson brought forward a formal motion discharging the order referring the petition for the Bill to the Select Committee on Standing Orders (on the Examiner's report of non-compliance); and the motion was agreed to.

Lancashire Miners and the Stacking of Coal.—Our Bolton Correspondent writes: The increased stacking of coal at most Lancashire collieries gives rise to very grave concern to the miners' leaders in that county; and recently efforts were made to ascertain the opinion of the men in regard to some united action for the restriction of the output. Meetings were held in the various colliery centres, and the reports were considered at a conference of the miners' delegates held at Bolton last Saturday morning—Mr. T. Greenall (Pendlebury) presiding, in the unavoidable absence of Mr. S. Woods, M.P. The proceedings were private; but it is understood that resolutions recommending united action on the part of the men to restrict the output were adopted for submission at the conference of the Lancashire and Cheshire Miners' Federation to be held in Manchester on the 20th inst. The same question will be considered at a meeting of the Miners' Federation to be held in London shortly. At a number of collieries in Lancashire, the hands have been put on three days a week; and a good deal of dissatisfaction is said to exist among the men.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 694.)

Issue.	Share	When ex-Dividend.	Dividend or Div. & Bonus.	NAME.	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	**GAS COMPANIES.**				£ s. d.
590,000	10	12 Apl.	10½	Alliance & Dublin 10 p. c.	10	17⅞–18⅛*	..	5 13 6
100,000	10	,,	7½	Do. 7 p. c.	10	12—13*	..	5 15 4
300,000	100	2 Jan.	8	Australian (Sydney) 5 % Deb.	100	106—108	..	4 12 6
100,000	20	14 Dec.	8½	Bahia, Limited	20	10—11	..	14 10 10
200,000	5	15 Nov.	6¼	Bombay, Limited	5	4¾—5¼	..	6 3 10
40,000	5	,,	6½	Do. New	4	3⅞—4	..	6 10 0
980,000	Stck.	28 Feb.	11½	Brentford Consolidated	100	217—222	..	5 3 7
180,000	,,	,,	8½	Do. New	100	165—170	..	5 0 0
820,000	Stck.	15 Mar.	11½	Brighton & Hove Original	100	205—215	..	5 6 11
888,500	Stck.	28 Feb.	5	Bristol	100	106—109	+1	4 11 9
320,000	20	29 Mar.	11¼	British	20	45—47	..	4 15 10
50,000	10	28 Feb.	11½	Bromley, Ordinary 10 p. c.	10	21—22	..	5 4 7
51,510	10	,,	8½	Do. 7 p. c.	10	15½—16½	..	5 3 0
328,750	10	28 July	2	Buenos Ayres (New) Limited	10	6—7	..	2 17 2
200,000	100	2 Jan.	6	Do. 6 p. c. Deb.	100	100—103	..	5 16 7
150,000	20	28 Feb.	8	Cagliari, Limited	20	26—27	..	5 18 6
550,000	Stck.	12 Apl.	12½	Commercial, Old Stock	100	250–255*	+1½	4 18 0
165,000	,,	,,	9½	Do. New do.	100	190–195*	+2½	4 17 5
160,762	,,	14 Dec.	4½	Do. 4½ p. c. Deb. do.	100	132—137	+4	3 5 8
800,000	Stck.	14 Dec.	13	Continental Union, Limited	100	232—237	+2	5 9 8
200,000	,,	,,	10	Do. 7 p. c. Pref.	100	204—209	+1½	4 15 8
535,000	Stck.	28 Feb.	5	Crystal Palace Ord. 5 p.c. Stk.	100	105—110	..	4 10 11
486,090	10	31 Jan.	10	European, Limited	10	22—23	..	4 6 11
354,060	10	,,	10	Do. Partly paid	7½	15½—16½	..	4 10 11
5,646,590	Stck.	14 Feb.	12	Gaslight & Coke, A, Ordinary	100	230—235	–2	5 2 1
100,000	,,	,,	4	Do. B, 4 p. c. max.	100	98—102	..	3 18 5
665,000	,,	,,	10	Do. C, D, & E, 10 p.c. Pf.	100	273—278	..	3 12 0
30,000	,,	,,	5	Do. F, 5 p. c. Prf.	100	130—135	..	3 14 1
60,000	,,	,,	7½	Do. G, 7½ p. c. do.	100	190—195	..	3 16 11
1,300,000	,,	,,	7	Do. H, 7 p. c. max.	100	175—180	..	3 17 9
463,000	,,	,,	10	Do. I, 10 p. c. Prf.	100	270—275	..	3 12 9
476,000	,,	,,	6	Do. K, 6 p. c. Prf.	100	163—168	..	3 11 5
1,061,150	,,	14 Dec.	4	Do. 4 p. c. Deb. Stk.	100	127—130	..	3 1 6
294,850	,,	,,	4½	Do. 4½ p. c. do.	100	130—135	..	3 6 8
908,000	,,	,,	6	Do. 6 p. c. do	100	177—182	..	3 5 11
3,800,000	Stck.	15 Nov.	12	Imperial Continental	100	220—225	+5	5 6 8
75,000	5	14 Dec.	6	Malta & Mediterranean, Ltd.	5	4⅛—5	..	6 0 0
560,000	100	2 Apl.	5	Met. of Melbourne, 5 p. c. Deb.	100	108—110	..	4 10 11
541,920	20	15 Nov.	5	Monte Video, Limited	20	13½—14½	..	6 18 0
150,000	5	30 Nov.	8	Oriental, Limited	5	6—6⅛	..	6 3 1
60,000	5	29 Mar.	7	Ottoman, Limited	5	3¾—4¼	..	7 7 4
166,870	10	31 Jan.	2	Pará Limited	10	2—2½	..	8 0 0
420,000	100	2 Nov.	6	People's Gas of Chicago—1st Mtg. Bds.	100	103—109	..	5 10 1
500,000	100	1 Dec.	6	2nd Do.	100	97—102	..	5 17 8
150,000	10	13 Oct.	5	San Paulo, Limited	10	9—10	+⅛	5 0 0
500,000	Stck.	28 Feb.	15½	South Metropolitan, A Stock	100	315—320	..	4 16 11
1,350,000	,,	,,	12	Do. B do.	100	253—258	–2	4 13 0
260,000	,,	,,	13	Do. C do.	100	260—265	..	4 18 1
750,000	,,	17 Jan.	5	Do. 5 p. c. Deb. Stk.	100	152—155	..	3 4 6
60,000	Stck.	28 Feb.	11½	Tottenham & Edm'nton, "A"	100	210—215	..	5 7 0
				WATER COMPANIES.				
745,967	Stck.	29 Dec.	10	Chelsea, Ordinary	100	272—277	..	3 12 3
1,720,252	Stck.	12 Apl.	8	East London, Ordinary	100	215–220*	+1	3 12 9
544,440	,,	29 Dec.	4½	Do. 4½ p. c. Deb. Stk.	100	147—150	..	3 0 0
700,000	50	14 Dec.	8½	Grand Junction	50	113—117	..	3 12 6
708,000	Stck.	28 Feb.	11½	Kent	100	288—293	..	3 18 6
1,043,800	100	29 Dec.	9½	Lambeth, 10 p. c. max.	100	248—253	..	3 15 1
406,200	100	,,	7½	Do. 7½ p. c. max.	100	200—205	..	3 13 2
310,000	Stck.	29 Mar.	4	Do. 4 p. c. Deb. Stk.	100	132—135	..	2 19 3
500,000	100	14 Feb.	12½	New River, New Shares	100	365—370	..	3 5 6
1,000,000	Stck.	31 Jan.	4	Do. 4 p. c. Deb. Stk	100	133—136	..	2 18 10
902,300	Stck.	14 Dec.	6	S'thwk & V'xhall, 10 p. c. max.	100	157—162	..	3 14 1
126,500	100	,,	6	Do. D 7½ p. c. do.	100	147—152	..	3 19 0
1,155,066	Stck.	14 Dec.	10	West Middlesex	100	265—270	..	3 14 1

*Ex div.

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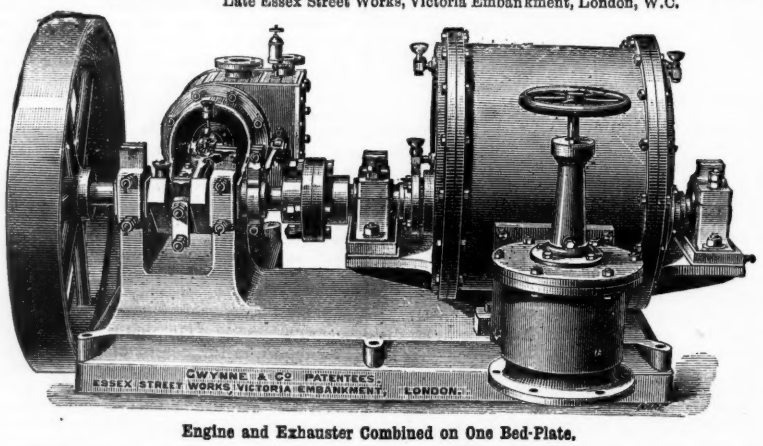

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Gas Purification and Chemical Company, Limited, Palmerston Buildings, Old Broad Street, London, E.C.
JOHN WM. O'NEILL, Managing Director.

GAS PURIFICATION AND CHEMICAL COMPANY, LIMITED.

ANDREW STEPHENSON, Agent. All communications *re* OXIDE to be addressed to PALMERSTON BUILDINGS, E.C.

BRIN'S Oxygen Company, Limited, Westminster. ANDREW STEPHENSON, Agent.

WINKELMANN'S "VOLCANIC" CEMENT. Fire Resistance up to 4500° Fahr. In use in most Continental Gas-Works, and in more than 300 British Gas-Works. [See Advt., p. 678.]
ANDREW STEPHENSON, 182, Gresham House, Old Broad Street, LONDON, E.C. Telegrams: "Volcanism, London."

LIQUOR, Tar, and Spent Oxide wanted.
BROTHERTON AND CO., Ammonia and Tar Distillers, BIRMINGHAM, LEEDS, and WAKEFIELD.

PORTER & CO., Gowts Bridge Works, LINCOLN, Engineers, Ironfounders, and Contractors for the erection of Gas-Works for, Towns, Villages, Mansions, Manufactories, Collieries, and Isolated Buildings, at home and abroad. Manufacturers of Retorts and Fittings, Condensers, Scrubbers, Purifiers, Valves, &c.; also of Girders, Wrought and Cast Iron Tanks, Iron Roofs, &c.
Telegraphic Address: "PORTER LINCOLN."

WANTED, by a Gas Engineer, an Engagement Abroad. Has had eight years' experience in South America as Engineer and Manager.
Apply, by letter, to No. 2355, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, by a Competent Man, a Situation as SERVICE LAYER, METER FITTER, INDICE READER, STOVE FIXER, &c. Total Abstainer.
Address No. 2370, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, by a practical Gas-Fitter (age 30) a Situation as METER INSPECTOR and FIXER, STOVE-FITTER, TINMAN, &c. Four years with the Hastings Gas Company. Unexceptional references.
Address E. RIDDLE, 4, South Terrace, HASTINGS.

£10 Bonus will be paid to any Gentleman procuring Advertiser (age 24) an appointment, within three months from date, as SECRETARY and MANAGER to a small Gas-Works. Thoroughly competent, and first-class testimonials.
Address No. 2372, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

HUNSTANTON GAS-WORKS.

WANTED, a Working Manager. Annual make, about 3 millions. Wages, 28s. House and Garden; with Fire and Light, free.
Apply to H. BRADFIELD, Chapel Street LYNN.

WANTED, a Gas Stoker for a small Works. Permanent Situation to a steady industrious Man, willing to make himself generally useful. Abstainer preferred.
Apply, stating wages required, and where last employed, to Mr. S. G. TULK, Builth Wells, BRECONSHIRE.

GAS MANAGER WANTED.

WANTED, by the Directors of the Amersham Gas-Works, a MANAGER to take charge of their Works, at Amersham. The Salary is £1 per week, with House, Firing, and Light.
Application to be made to the SECRETARY, High Street, AMERSHAM.

WANTED, a Young Man (with good character), who thoroughly understands Gas Fittings and Stoves, for a Show-Room about to be opened by a Gas Company in the Eastern Counties. Must be willing to make himself generally useful.
Apply, by letter, to No. 2371, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

SOWERBY BRIDGE LOCAL BOARD.

WORKING Foreman required for the Gas-Works, making 100 millions. Must be a good Carbonizer, able to control men, and thoroughly acquainted with Engine, Exhauster, and general Working. Wages not less than £2 per week.
Applications, stating age and accompanied by copies of two recent testimonials, must be addressed to the Chairman of the Gas Committee, Gas-Works, Sowerby Bridge, not later than Thursday, April 19, 1894.
JOHN MARSLAND,
Engineer and Manager.
Gas-Works, Sowerby Bridge,
April 4, 1894.

JAMES LAWRIE & Co. supply Best SCOTCH CANNEL COALS, Best FIRE-CLAY RETORTS, BRICKS, TILES, and LUMPS; BOILER SEATING BLOCKS, FLUE COVERS, and SILICA BRICKS for SPECIAL FURNACE WORK; COKE BARROWS, BOGIES, and SMALL WAGONS.
Postal Address: 1, WHITTINGTON AVENUE, E.C.
Telegram Address: "EIRWAL LONDON."

W. C. HOLMES & CO., Huddersfield; AND 80, CANNON STREET, LONDON,
Contractors for Gas-Works complete, Makers of Gasholders, Purifiers, Scrubbers, Condensers, Retort Fittings, &c., Improved Valves, Engines, and Exhausters. Also for Collingwood's Regenerative Retort-Settings.
*** See Advertisement p. 689 of this week's issue.
Cablegrams: "Ignitor London." Telegrams: "Holmes Huddersfield."

J. & J. BRADDOCK, Globe Meter Works, Oldham.
First-Class Award, Melbourne Exhibition, 1889, for WET AND DRY GAS-METERS, STATION METERS, AND GOVERNORS, PRESSURE-GAUGES, STREET LAMPS AND PILLARS, &c.
Telegraphic Address: "Braddock Oldham."

SULPHURIC ACID.

JOHN NICHOLSON & SONS, Chemical Works, Leeds, specially produce this ACID from BRIMSTONE, for making SULPHATE OF AMMONIA of high quality and *good* colour. Delivery in our own Railway Tank-Wagons or Carboys. Highest references and all particulars supplied on application.

PATENTS, DESIGNS, AND TRADE MARKS.

INVENTIONS Protected by Letters Patent. TRADE MARKS REGISTERED at home and abroad. Advice on all questions relating to above. Handbook gratis.
Apply to J. C. CHAPMAN, Chartered Patent Agent, 70, Chancery Lane, LONDON.

SPECIAL PAINT FOR GAS-WORKS.

JOHN E. WILLIAMS AND CO.,
VICTORIA PAINT WORKS, MANCHESTER.
Telegrams: "ENAMEL." National Telephone 1759.
GAS PLANT CEMENT
FOR ALL LEAKAGES.

HYDRATED OXIDE OF IRON.

PREPARED from pure Iron
Two or three times as rich as Bog Ore.
Strong action on Sulphuretted Hydrogen.
To be used alone, but will increase activity of other Oxides.
Less than half the price of Bog Ore.
Can be lent on hire.
Write for tabulated results.
READ HOLLIDAY AND SONS, LIMITED, HUDDERSFIELD.

ULVERSTON LOCAL BOARD.

TO TAR DISTILLERS.

THE Gas and Water Committee invite TENDERS for the purchase of the surplus TAR produced at their Works during the Year commencing the 1st of July next.
Further Particulars and Forms of Tender may be had on application to the undersigned.
Sealed tenders to be sent in not later than the 26th inst., addressed to the Chairman of the Gas and Water Committee, and endorsed "Tender for Tar."
The Committee do not bind themselves to accept the highest or any tender.
JNO. SWAN,
Engineer and Manager.

ULVERSTON LOCAL BOARD.

TENDERS FOR COAL AND CANNEL.

THE Gas and Water Committee invite TENDERS for the supply of best screened GAS COAL, NUTS, and CANNEL, for One, Two, or Three Years, commencing the 1st of July next.
Parties tendering must give full particulars of the Coal and Cannel they propose to supply, and name the Pit from which the same will be raised.
Further Information and Forms of Tender may be obtained on application to the undersigned.
Sealed tenders to be sent in not later than the 26th inst., addressed to the Chairman of the Gas and Water Committee, and endorsed "Tender for Coal" or "Cannel."
The Committee do not bind themselves to accept the lowest or any tender.
JNO. SWAN,
Engineer and Manager.

TIPTON GAS-WORKS.

THE Gas Committee of the Tipton Local Board invite TENDERS for the supply of FIRE-CLAY RETORTS, BRICKS, PATENT REGENERATOR TILES, &c.
Specification and Form of Tender may be obtained at the Gas-Works, on application to Mr. Vincent Hughes, the Engineer and Manager.
Sealed and endorsed tenders to be sent to me, the undersigned, not later than Ten a.m., on Monday, April 23 inst.
The Committee do not bind themselves to accept the lowest or any tender.
By order,
GEO. M. WARING,
Clerk to the Board.
Public Offices, Tipton.
April 6, 1894.

IRISH BOG ORE OXIDE OF IRON.

GAS PURIFICATION.

BALE & CO., direct Importers from Ireland. Sample and Price on application.
OXIDE PAINT, SULPHURIC ACID, & Chemicals.
120 and 121, NEWGATE STREET, LONDON, E.C.
Telegrams: "BOGORE LONDON."

OXIDE OF IRON.

FINEST Quality of Natural Bog Ore. Particulars and price, apply to Mr. T. L. ARCHER, 20, Fennel Street, MANCHESTER.

SADLER AND CO., LIMITED, MIDDLESBROUGH; ULVERSTON (BARROW); PORTSMOUTH; CARLTON; STOCKTON; 315, St. Vincent Street, GLASGOW; and 85, Water Street, NEW YORK. Tar Distillers, Manufacturers of all TAR PRODUCTS, ALIZARINE and other TAR COLOURS, BICHROMES, OXALIC ACID, ALKALIES, LIQUOR AMMONIA, AMMONIA SULPHATE, &c.
Head Office: MIDDLESBROUGH. Correspondence invited.

ALWAYS a Buyer of Spent Oxide, Tar, and AMMONIACAL LIQUOR.
Apply to J. HARDMAN, Milton, STAFFORDSHIRE.

NEW ROMNEY GASLIGHT AND COKE COMPANY, LIMITED.

ISSUE OF £500 DEBENTURES.

THE Directors are prepared to issue ten DEBENTURES for £50 each, with Interest at 5 per cent. per annum.
Tenders to be sent to the Secretary on or before Thursday, the 26th inst.
W. ALLEN,
Secretary.
New Romney, Kent.

SLOUGH GAS AND COKE COMPANY.

THE Directors of this Company invite TENDERS for the supply of 4-inch (about one mile) and 3-inch (about 300 yards) MAIN PIPES, delivered at the Slough Railway Station.
Tenders, specifying thickness, weight, and other particulars, addressed to the Chairman, R. Martin, Esq., Castleview, Chalvey, near Slough, and endorsed "Tender for Mains," to be delivered on or before Tuesday, the 24th inst.
The Directors do not bind themselves to accept the lowest or any tender.
ARTHUR THOMAS,
Secretary,
April 11, 1894.

SLOUGH GAS AND COKE COMPANY.

THE Directors are prepared to receive TENDERS for a new 7-HORSE POWER EGG BOILER. Also a new or second-hand WASHER (Good's preferred).
Specifications may be seen on application to Mr. T. Webb, the Manager at the Works, Slough.
Tenders, addressed to the Chairman, R. Martin, Esq., Castleview, Chalvey, near Slough, endorsed "Tender for Boiler," or "Washer," to be delivered on or before Tuesday, the 8th prox.
The Directors do not bind themselves to accept the lowest or any tender.
ARTHUR THOMAS,
Secretary.
April 11, 1894.

COUNTY BOROUGH OF BURY.

TO SULPHURIC ACID MAKERS.

THE Gas Committee of the Bury Corporation are prepared to receive TENDERS for the supply of about 300 tons of SULPHURIC ACID for the Manufacture of Sulphate of Ammonia, for a period of One Year, from the 1st of May, 1894.
Form of Tender and Conditions may be obtained upon application to the undersigned.
Tenders, to be endorsed "Tender for Sulphuric Acid," and sent to J. Haslam, Esq., Town Clerk, Bury, on or before the 23rd inst.
By order,
W. H. S. GENDALL,
Engineer and Manager.
Gas-Works, Elton, Bury,
April 6, 1894.

COUNTY BOROUGH OF BURY.

TO IRON ROOF AND GIRDER MAKERS.

THE Gas Committee of the Corporation of Bury invite TENDERS for the making and erecting of IRON ROOF and GIRDER in connection with their Coal-Stores, at the Gas-Works, Elton, pursuant to the Drawings and Specification prepared by Mr. W. H. S. Gendall, Gas Engineer, from whom further particulars may be obtained, and also copies of the Specification with Quantities, and Form of Tender, on payment of One Guinea, which sum will be returned upon receipt of a *bonâ fide* tender.
Tenders, endorsed "Tender for Iron Roof," to be sent to me the undersigned, on or before Monday, the 23rd inst.
JOHN HASLAM,
Town Clerk.
Corporation Offices, Bury,
April 7, 1894.

INVERNESS CORPORATION GAS-WORKS.

THE Inverness Gas Commissioners are prepared to receive OFFERS for 6000 tons of GAS COAL and 250 tons of SHELL LIME, to be delivered during the next Twelve Months as may be required. Intending Offerers to state their price delivered free at Inverness Station or Harbour.

Tenders, endorsed "Tender for Coal" or "Lime," and addressed to Kenneth Macdonald, Esq., Clerk to the Commissioners, will be received up to Tuesday, the 1st of May.

Gas Office, Inverness,
April 13, 1894.

COCKERMOUTH LOCAL BOARD.
(GAS DEPARTMENT.)

TENDERS are invited for the following:

Set of four 10-feet PURIFIERS, with Centre-Valve and all necessary Connections, &c.

The supply and erection of a complete SULPHATE OF AMMONIA PLANT.

Drawings and Specifications may be seen on application to the undersigned.

Endorsed tenders to be delivered at the Gas-Works not later than the 1st of May next.

The Committee do not bind themselves to accept the lowest or any tender.

ER W. SMITH,
Gas Manager.

ABERGAVENNY GAS-WORKS.

TENDERS are invited for Repairs to a GASHOLDER at the Abergavenny Gas-Works, including the supply and fixing, &c., of Ten WROUGHT-IRON GOOSE-NECK CARRIAGES, &c.

For full Particulars, apply to Mr. S. Cross, the Manager, at the Gas-Works.

Tenders to be delivered to the undersigned not later than the 30th of April, 1894.

A contract to be entered into for due performance.

The lowest or any tender not necessarily accepted.

Tenders to be endorsed "Gasholder Repairs."

By order,
J. T. RUTHERFORD,
Clerk.

Abergavenny Improvement Commissioners,
Town Hall, Abergavenny,
April 13, 1894.

BOROUGH OF BEVERLEY.

TENDERS FOR TAR.

THE Corporation of Beverley desire to receive TENDERS for the purchase of the surplus TAR at the Gas-Works for One Year from the 1st of May next.

The Tar will be delivered by the Corporation at the Railway Station, Beverley, into Tanks to be provided by the Contractor.

Tenders, endorsed "Tender for Tar," must be delivered at my Office on or before the 25th day of April.

Further particulars may be obtained of the Gas Manager at the Works.

By order,
JAMES MILLS,
Town Clerk.

April 10, 1894.

CORPORATION OF MANCHESTER.

TENDERS FOR COAL AND CANNEL.

THE Gas Committee are prepared to receive, on or before Wednesday, the 23rd of May next, OFFERS of High-Class CANNELS and COALS suitable for gas-making, for delivery, at their Gaythorn, Rochdale Road, and Bradford Road Works, during a period of One, Two, or Three Years, commencing the 1st of July, 1894.

Particulars and printed Forms of Tender may be obtained on application (in writing only) to Mr. Charles Nickson, Superintendent, Gas Department, Town Hall, Manchester.

By order of the Gas Committee,
WM. HENRY TALBOT,
Town Clerk.

Town Hall, Manchester,
April 13, 1894.

THE FARNHAM GAS COMPANY, LIMITED.

TENDERS FOR COAL.

THE Directors of the Farnham Gas Com- pany, Limited, are prepared to receive TENDERS from Persons willing to supply and deliver free of all Dues and Charges, at the Farnham Station, London and South-Western Railway, 1900 tons of the following descriptions of GAS COAL—viz., New Pelton, Pelaw Main, Aldwarke Main, or Strafford Silkstone—to be delivered in quantities of 50 tons (at intervals) before the 31st of March, 1895. The Coals to be consigned to the order of the Farnham Gas Company, Limited, at the Farnham Railway Station.

In the case of Seaborne Coal, the Meter's Certificate of each quantity to be duly sent with Invoice of same.

Payment monthly.

Sealed tenders, marked "Tender for Coal," to be delivered to the Secretary, Mr. W. Wells, 112, West Street, Farnham, Surrey, not later than Eleven o'clock a.m., on Monday, the 7th of May, *of whom Forms of Tender may be obtained.*

The Directors reserve the right to reject the lowest or any tender.

April 10, 1894.

THE East Dereham Local Board are prepared to receive TENDERS for the supply of about 1200 tons of screened GAS COAL for the ensuing Year.

Conditions and Form of Tender to be had of the undersigned.

Tenders to be sent in by the 2nd of May, 1894.

B. H. VOBES,
Clerk to the Local Board.

East Dereham.

ASHFORD, KENT.

THE Directors of the Ashford Gas and Coke Company, Limited, are prepared to receive TENDERS for the supply of 3500 tons of GAS COALS and 3500 gallons of GAS OIL, to be delivered at their Works, Ashford (Kent), in equal monthly quantities, from the 1st of July next to the 30th of April, 1895.

Tenders, specifying the description of Coals, the pits at which they are raised, the quality of the Oil, and terms for net monthly payments, to be sent to me on or before Thursday, May 3, endorsed "Tenders for Coals and Oil."

F. HUGHES HALLETT,
Secretary.

Ashford, April 11, 1894.

SMETHWICK GAS-WORKS.

TENDERS FOR GAS COAL AND LIME.

THE Gas Committee of the Smethwick Local Board of Health invite TENDERS for the supply of about 10,000 tons of GAS COAL for delivery over the Year ending the 30th of June, 1895.

Forms of Tender may be obtained from the undersigned.

TENDERS are also invited for the supply of about 250 to 300 tons of PURIFYING LIME during the same period.

Sealed tenders, endorsed "Tender for Gas Coal," or "Lime" (as the case may be), and accompanied, if possible, by an Analysis, to be addressed to the Chairman of the Gas Committee, and delivered to the undersigned on or before the 26th of April inst.

By order,
W. J. STURGES,
Secretary.

Public Buildings, Smethwick,
April 10, 1894.

CARDIFF GASLIGHT AND COKE COMPANY.

TENDERS FOR COAL.

THE Directors of the above Company are prepared to receive TENDERS for a supply of 45,000 tons of best, well-screened, large GAS COAL, to be delivered between July, 1894, and the 30th of June, 1895, in monthly quantities in accordance with the Specification.

Parties tendering may do so for the whole quantity or for quantities from 5000 tons upwards.

Forms of Tender and Specification of monthly deliveries may be obtained on application to Mr. H. Morley, the Company's Engineer.

Sealed tenders to be sent to the undersigned not later than Thursday, the 3rd day of May next, addressed to the Chairman of the Company, and endorsed "Tender for Coal."

The Directors do not bind themselves to accept the lowest or any tender, and reserve to themselves the right to apportion the whole quantity as they may think fit.

By order,
GEORGE CLARRY,
Secretary.

Gas Offices, Cardiff,
April 11, 1894.

LYMM LOCAL BOARD.

TO GASHOLDER MAKERS.

THE above Board are prepared to receive TENDERS for a TELESCOPIC GASHOLDER, to replace the old single one, which is 40 feet diameter, by 12 feet deep, either with or without Columns.

Drawings and Specifications, showing method of construction, must be sent to me the undersigned, from whom further Particulars may be had.

The person whose tender is accepted will be required to enter into a Contract with the Local Board for the due performance of the Work, and to give security to be approved of by the Board.

The Local Board will pump the Water out of the present Tank, and remove the old Gasholder, which will be retained, and kept by the Board.

A Copy of the Contract can be seen at the Local Board Office, Pepper Street, Lymm, on any Tuesday or Friday between Ten and Twelve, or Two and Five; or copies can be had on payment of 10s. 6d. each copy, which must be remitted with the application.

The person tendering must prepare his own Drawings of the Plant he contracts for, showing details, and submit them to the undersigned *three* clear days prior to the tender being sent in to the Local Board.

Sealed tenders, endorsed "Gasholder," must be delivered to William Mullard, Esq., Clerk to the Local Board, on or before the 28th day of April, 1894.

The Local Board do not bind themselves to accept the lowest or any tender.

W. SEVERS,
Gas Manager.

Local Board Offices, Lymm,
April 14, 1894.

TENDERS FOR COAL.

THE Directors of the Derby Gaslight and Coke Company are prepared to receive TENDERS for the supply of 40,000 tons of COAL or NUTS.

Particulars may be obtained from the undersigned.

Sealed tenders, endorsed "Tender for Coal," and addressed to the Chairman of the Finance Committee, must be delivered at the Offices of the Company, Friargate, on or before Wednesday, the 25th day of April inst.

RICHARD FISHER,
Secretary.

Gas Office, Derby,
April 4, 1894.

SOUTH SHIELDS GAS COMPANY.

TO METER MANUFACTURERS.

THE Directors of the South Shields Gas Company invite TENDERS for the supply of DRY GAS-METERS required during the Year ending the 12th of May, 1895.

The Meters must be of best quality, and delivered at the Gas-Works, carriage paid.

The Directors do not bind themselves to accept the lowest or any tender.

Form of Contract and further particulars may be had on application.

Sealed tenders, marked "Tender for Meters," to be delivered to the undersigned not later than Friday morning, the 27th inst.

J. H. PENNEY,
Secretary

Gas Offices: Chapter Row,
South Shields, April 17, 1894.

Just published.
With numerous Illustrations and Tables, crown 8vo. cloth, 6s.

THE
GAS ENGINEER'S LABORATORY HANDBOOK,

By JOHN HORNBY, F.I.C.

Honours Medallist in Gas Manufacture, City and Guilds of London Institute.

LONDON: E. & F. N. SPON, 125, Strand.
NEW YORK: 12, Cortlandt Street.

HOLMSIDE GAS COALS.
(Wrought out of Holmside and South Moor Collieries.)

PRESENT production 4000 tons per working day. Area of coal about 5000 acres, including the largest remaining workable proportion of pure HUTTON SEAM GAS COAL. Analysis of HOLMSIDE GAS COAL *in bulk as shipped* gives 10,500 cubic feet of Gas per ton, of an Illuminating Power of 16½ candles. The Sulphur is about 1 per cent., and the Ash 1¾ per cent. The Coal cokes well, and leaves about 70 per cent. of excellent Coke. To show the progress of HOLMSIDE COALS, it may be mentioned that the quantity carbonized by the London Gas Companies in 1885 was about 200,000 tons; whereas the present consumption of HOLMSIDE COALS in London alone is at the rate of nearly

600,000 Tons per Annum.

Full particulars on application to
MR. MARK ARCHER,
HOLMSIDE AND SOUTH MOOR OFFICES
NEWCASTLE-ON-TYNE.

CAST-IRON PIPES
FOR GAS AND WATER.

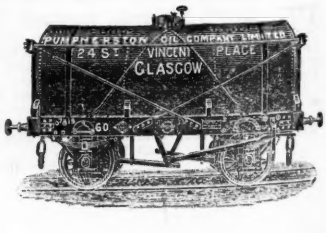
Pipes, One to Six inch Bore, kept in Stock. Also a very large assortment of all sizes of Bends, T-pieces, and Specials ready for despatch on receipt of Order.

VALVES
FOR GAS, WATER, AND STEAM.

TELEGRAMS: "PIPES GLASGOW."
WM. MACLEOD & CO.,
56, ROBERTSON STREET, GLASGOW.

OIL GAS

BETTER TERMS CAN BE OBTAINED
FROM SUPPLIERS OF OIL
IF PURCHASERS HAVE THEIR OWN
TANK-WAGGONS.
HURST, NELSON, & Co., LTD.,
THE GLASGOW ROLLING STOCK AND PLANT WORKS, MOTHERWELL.
REGISTERED OFFICE:
27, ST. VINCENT PLACE, GLASGOW.



PRICE'S PATENT COKE & COAL BARROW

effecting a great saving of time, labour, and expense.

For particulars, price, &c., apply to Mr. E. PRICE, Inventor and Patentee, 92, Alwyne Road, Canonbury, LONDON, N.

Prices are Reduced.

NEWBATTLE CANNEL.

Highest Results in Gas, & Excellent Coke.

QUOTATIONS ON APPLICATION TO

THE LOTHIAN COAL COMPANY,

LIMITED,

NEWBATTLE COLLIERIES,

DALKEITH, N.B.

LONDONDERRY GAS COALS

FROM THE

MARQUIS OF LONDONDERRY'S COLLIERIES,

COUNTY OF DURHAM.

Available output up to 5000 tons per day.
Yield of Gas 11,000 cubic feet per ton of Coal as per analysis by Mr. John Pattinson, F.C.S., F.I.S.

FOR PRICES AND PARTICULARS, APPLY TO

S. J. DITCHFIELD,

SEAHAM HARBOUR, COUNTY OF DURHAM.

Awarded HIGHEST MEDAL and DIPLOMA at the Newcastle-on-Tyne Royal Mining and Industrial Exhibition, 1887, for

CANNEL & COAL.

TYNE BOGHEAD CANNEL.

Yield of Gas per ton	13,155 cub. ft.
Illuminating Power	38·22 candles.
Coke per ton	1,301·88 lbs.

EAST PONTOP GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·3 candles.
Coke	70 per cent.

SOUTH PELAW MAIN GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·3 candles.
Coke	73·1 per cent.

For Prices and complete Analysis, apply to

THOS. W. DANCE & SONS,

COAL OWNERS, NEWCASTLE-ON-TYNE;

OR

E. FOSTER & CO.,

21, JOHN STREET, ADELPHI, LONDON, W.C.

ROBERT MARSHALL,

CANNEL COAL MERCHANT,

97, WELLINGTON STREET, GLASGOW.

Prices and Analysis of all the Scotch Cannels on Application.

HUNTER'S

OXIDE OF IRON.

JAMES HUNTER, LESSEE, MINER, AND SHIPPER OF NATURAL IRISH BOG ORE.

This Estate yields the finest and most uniform quality in Ireland; and the quality is guaranteed.

Samples and Prices on application.

11, BAY STREET, PORT GLASGOW.

Telegrams: "HUNTER, PORT GLASGOW."

Established 1872.

BOLDON GAS COALS.

Worked by THE HARTON COAL CO., LTD.

Output about 3000 tons per day.

ANALYSIS—

Yield of Gas per ton	10,500	Cubic Feet.
Illuminating Power	16·9	Candles.
Coke	66·7	Coke.
Sulphur	0·86	Sulphur.
Ash	2·04	Ash.

Boldon Gas Coals are supplied under contract to

The Gaslight and Coke Company, South Metropolitan Gas Company, Commercial Gas Company, Imperial Continental Gas Association, European Gas Company, L'Union des Gaz (the Continental Union Gas Company), Ipswich Gaslight Company, Devonport Gas Company, Newcastle Gas Company, Sunderland Gas Company, South Shields Gas Company, and to many other Companies at Home and Abroad.

For prices, &c., apply to the

HARTON COAL COMPANY,

LIMITED,

Newcastle-on-Tyne.

W. H. PARKINSON,
FITTER.

THE DRUM

FOR PUMPING AIR, WATER, SEMI-FLUIDS, &c.

See Advertisement in last and next issue.

T. B. KITTEL, SHEFFIELD.

CONTRACTS FOR SUPPLIES OF ANY OF THE PRINCIPAL

ENGLISH & SCOTCH CANNELS.

REAL SILKSTONE GAS COAL

ANALYSIS AND PRICES ON APPLICATION.

T. B. KITTEL, SHEFFIELD.

UNEQUALLED.

Gas Companies are solicited to try Samples of the

MIRFIELD

BLACK BED GAS COAL:

Prices and Analysis on application.

MIRFIELD (GAS-COAL) COLLIERY COMPY.

RAVENSTHORPE, NEAR DEWSBURY.

THOMAS TURTON AND SONS, LIMITED,

SHEAF WORKS, SHEFFIELD,

MANUFACTURERS OF

FILES OF BEST QUALITY

FOR ENGINEERS.

STEEL OF ALL DESCRIPTIONS.

SCREW STOCKS, TAPS AND DIES, SPANNERS, RATCHET BRACES, LIFTING JACKS, ANVILS, VICES, AND ENGINEERS' TOOLS GENERALLY.

London Office:

90, CANNON STREET, E.C.

THORNLEY GAS COALS

WORKED BY THE

WEARDALE IRON AND COAL COMPANY, Ld.

OUT OF THEIR

THORNLEY AND WHEATLEY HILL COLLIERIES.

The Analysis made by Messrs. J. and H. T. Pattinson, Public Analysts for Northumberland, gives 10,500 cubic feet of Gas per ton, with an Illuminating Power of 16·3 Candles and 67·3 per cent. of Coke. The following is a Working Analysis made of these Coals by the Tudhoe and Sunderland Bridge Gas Company:—

[COPY.]

TUDHOE AND SUNDERLAND BRIDGE GAS COMPANY.
Tudhoe Gas-Works,
Spennymoor,
8th June, 1893.

Messrs. The

WEARDALE IRON & COAL COMPANY, LTD.

GENTLEMEN,

For the last two months we have used your **THORNLEY GAS COAL** exclusively at these gas-works; and I have pleasure in herewith giving you the actual results obtained during the trial.

Yield of Gas per ton: 10,300 cubic feet.
Yield of Coke: 13½ cwt.

Illuminating Power of Gas, average of a series of tests, **17 Sperm Candles.**

The Coke was of excellent quality.

The following is a complete ultimate Analysis of the Coal.

	Per Cent.
Carbon	83·128
Hydrogen	5·116
Oxygen	7·401
Nitrogen	0·585
Sulphur	0·620
Ash	3·130
Water	0·020
	100·000

Analysis of the Coke.

Carbon	93·31
Sulphur	0·61
Ash	5·00
Moisture	1·08
	100·00

I am, Gentlemen,
Yours truly,
A. B. COWAN,
Manager.

For Price, &c., apply to the

WEARDALE IRON & COAL Co., Ld.

QUAYSIDE, NEWCASTLE-ON-TYNE.

TELEGRAPHIC ADDRESS: "ROBUSTNESS, LONDON." EXCHANGE TELEPHONE 1766.

GASEOUS FIRING
FOR LARGE OR SMALL
RETORT-SETTINGS
PLANS, SPECIFICATIONS, AND ESTIMATES SUBMITTED.

SPECIALTIES

J. & H. ROBUS,
20, BUCKLERSBURY, LONDON, E.C.
ENGINEERS & CONTRACTORS
FOR THE ERECTION OF GAS AND WATER WORKS COMPLETE, AND FOR EXTENSIONS AND RENEWALS.

IMPORTANT TO ENGINEERS AND GAS COMPANIES.

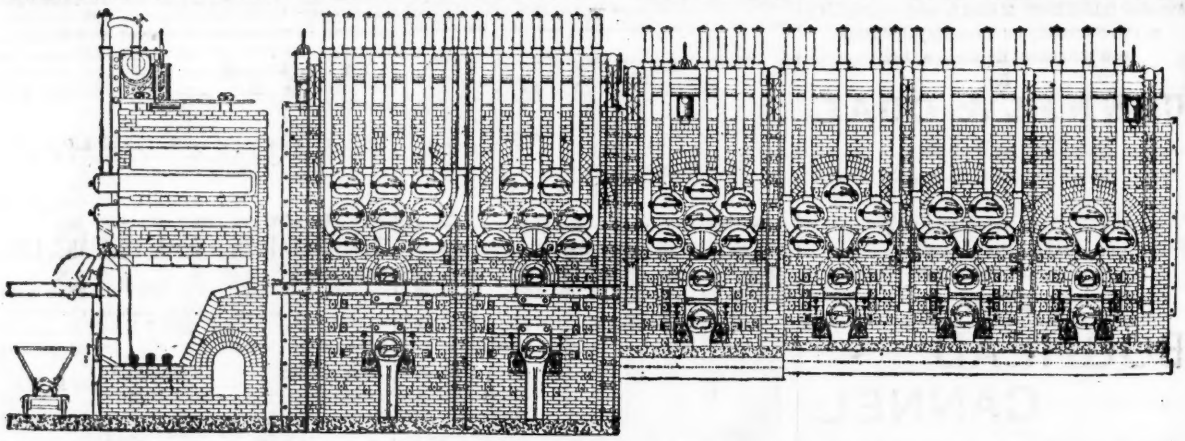
A NEW CARBURETTOR FOR ENRICHING GAS IN BULK.

The Carburettors have been doing practical work for the past two years; in many cases doing all the enrichment without the use of Cannel or other rich Coals. The South Metropolitan Gas Company have these Enrichers at all their Stations. The Gaslight and Coke Company have had them in use at some of their principal Works for two years past; and several more are now being fixed at their other Stations. The Carburettors are also in use at several Suburban and Provincial Gas Companies' Works.

FOR PRICES AND FULL PARTICULARS, APPLY TO

THE GAS LIGHTING IMPROVEMENT COMPANY, LIMITED,
18, DEVONSHIRE STREET, BISHOPSGATE, LONDON.

HISLOP'S PATENT REGENERATIVE SETTINGS OF GAS-RETORTS.



THESE SETTINGS ARE ADAPTED TO THE REQUIREMENTS OF ALL GAS COMPANIES AND GAS CORPORATIONS, AND HAVE ALREADY BEEN VERY EXTENSIVELY ADOPTED. THEY ARE ERECTED UPON BOTH THE WORKING-STAGE AND SHALLOW-CHAMBER SYSTEMS, AND EQUALLY SATISFACTORY RESULTS ARE GUARANTEED IN BOTH CASES.

THE SETTINGS HAVE ATTAINED TO A MEASURE OF SUCCESS AND POPULARITY QUITE UNEQUALLED BY THAT OF ANY OTHER WITHIN THE SAME SPACE OF TIME. THE WORKING RESULTS OBTAINED, AND THE GENERAL SATISFACTION GIVEN, ARE DECLARED IN EVERY CASE TO EXCEED, AND IN MOST CASES CONSIDERABLY EXCEED, THE PATENTEE'S GUARANTEE. THE CONSTRUCTION AND WORKING OF THE PATENT PRODUCER AND THE PATENT CHARGING APPARATUS FOR SAME ARE ABSOLUTELY UNIQUE AND UNRIVALLED, AND ARE THE DELIGHT OF EVERY STOKER; WHILE IN EVERY OTHER PARTICULAR THEY SECURE THE HIGHEST RESULTS ATTAINABLE BY ANY REGENERATIVE SYSTEM, AND AT A MINIMUM OF COST.

Drawings and Specifications are furnished for the complete erection of Ovens, with or without Retort and Bench Mountings, or complete erection undertaken if required, and carried out by specially Trained Workmen.

Further particulars may be obtained on application to the Patentee's Agents: C. M. HAMILTON, 5, Stuart Street, Shawlands, Glasgow; J. E. FISHER, Stourbridge; JOHN WALSH & SONS, Retort Builders, Halifax, Yorkshire; RICHARD TURNER, Retort Builder, Denton, Lancashire; and from the Principal Agent, R. F. HISLOP (son of Patentee), Gas-Works, Paisley, N.B.

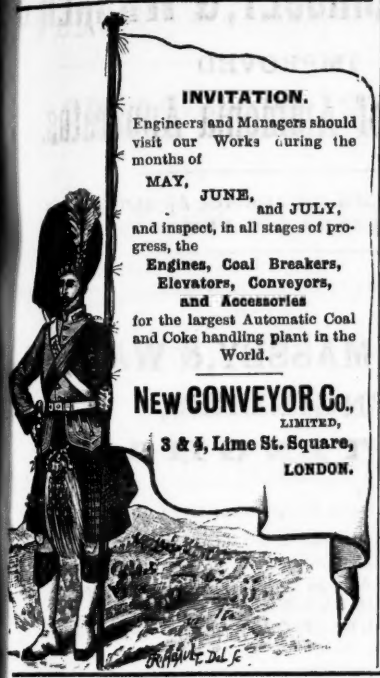
HISLOP'S PATENT HYDRAULIC MAIN SEAL-REGULATING AND TAR-EXTRACTING VALVE is a *Sine quâ non*
TO THE SATISFACTORY WORKING OF THE HYDRAULIC MAIN UNDER THE REGENERATIVE AS WELL AS OTHER SYSTEMS OF RETORTS. BEING LARGELY ADOPTED, AND AFFORDING THE HIGHEST SATISFACTION.

SPENT LIMES NO LONGER WASTE PRODUCTS
Under G. R. HISLOP'S Patents, all Spent Limes are most effectually, economically, and continuously recovered at from one-third to one-half the cost New Lime. The results are a surprise to all who have inspected the process, and are entirely satisfactory to all now using it.

Descriptive Pamphlets and Terms from Agents as above.

TROTTER, HAINES, & CORBETT,
Brettell's Estate
FIRE-CLAY & BRICK WORKS,
STOURBRIDGE.

Manufacturers of GAS-RETORTS, GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICKS.
Proprietors of
BEST GLASSHOUSE POT & CRUCIBLE CLAY.
Shipments Promptly and Carefully Executed.



INVITATION.

Engineers and Managers should visit our Works during the months of
MAY, JUNE, and JULY,
and inspect, in all stages of progress, the
Engines, Coal Breakers, Elevators, Conveyors, and Accessories
for the largest Automatic Coal and Coke handling plant in the World.

NEW CONVEYOR Co.,
LIMITED,
3 & 4, Lime St. Square,
LONDON.

THE SILICA FIRE-BRICK COMPANY,
OUGHTIBRIDGE, near SHEFFIELD,
MANUFACTURE
SILICA BLOCKS, BRICKS, AND CEMENT
OF SUPERIOR QUALITY
FOR GAS-FURNACES.
Trade Mark: "SILICA."

These Goods (largely used in Gas, Glass, Iron, and Steel Works) are, on account of their
GREATER DURABILITY
Strongly recommended where EXCESSIVE HEATS have to be maintained.

JAMES WHITE & CO., LTD.,
WIDNES, LANCASHIRE,
Manufacturers of Special
FIRE-BRICKS, FIRE-CLAY, & FURNACE CEMENT.

FOR GAS FURNACES our GANNISTER and SILICA FIRE-BRICKS are acknowledged to be the best and most durable in the Market.

GANNISTER and SILICA FIRE-CLAY guaranteed of the Purest Quality.

FURNACE CEMENT specially made for repairing Furnaces and stopping Cracks.

ANALYSIS AND REFERENCES ON APPLICATION.

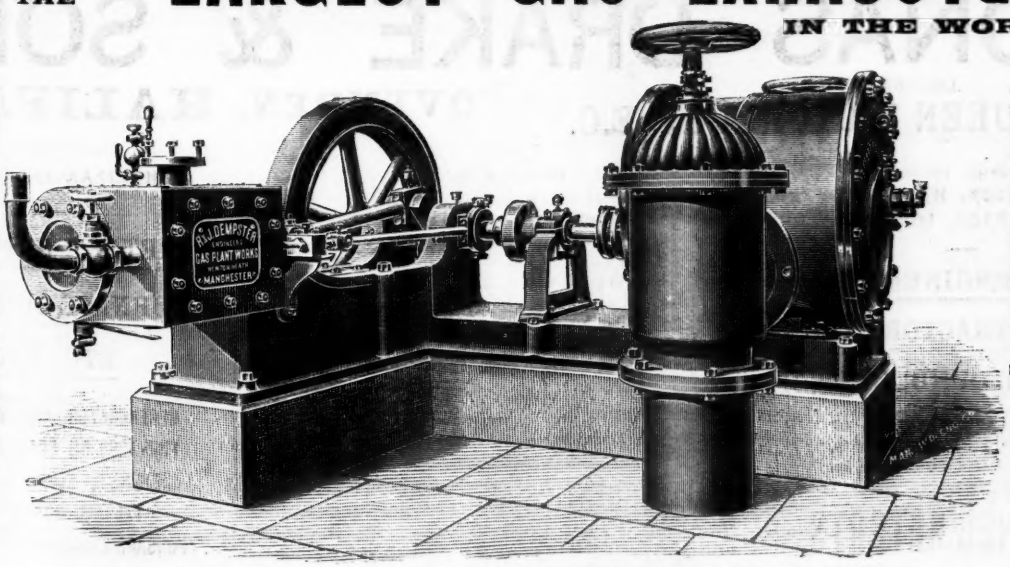
JAMES OAKES & Co.,
ALFRETON IRON-WORKS, DERBYSHIRE,
AND
Wenlock Iron Wharf, 21 & 22, Wharf Road,
CITY ROAD, LONDON, N.,
Manufacture and keep in Stock at their Works
(also large stock in London)
PIPES and CONNECTIONS, 1¼ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.
NOTE. — Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with bolts, nuts and covers, and rendering leakage impossible.

Lanemark Coal Co.,
LIMITED.
LANEMARK CANNEL AND GAS COALS.
Quotations and Analysis on application to
LANEMARK COLLIERY,
NEW CUMNOCK, N.B.
Shipping Ports: All the principal Scotch Ports.

R. & J. DEMPSTER, Ltd.,
GAS PLANT WORKS, NEWTON HEATH, MANCHESTER.

ARE THE **MAKERS** OF THE **LARGEST GAS EXHAUSTERS IN THE WORLD.**

During the past *FIVE YEARS*, we have made at these Works, Rotary and Reciprocating Exhausters, passing more than 21 250,000 Cubic Feet of Gas per Hour.



Capacity of our largest Exhauster **2,000,000** Cubic Feet of Gas per Hour.

VIEW OF COMBINED STEAM-ENGINE AND ROTARY EXHAUSTER, CAPABLE OF PASSING 100,000 CUBIC FEET PER HOUR.

DESIGNS AND ESTIMATES FREE ON APPLICATION.

LONDON OFFICE: 181, GRESHAM HOUSE, OLD BROAD STREET, E.C.

ALEX. C. HUMPHREYS, M.E.,
General Superintendent & Chief Engineer,
The United Gas Improvement Company, U.S.A.

A. G. GLASGOW, M.E.,
Late General Inspector,
The United Gas Improvement Company, U.S.A.

HUMPHREYS & GLASGOW,

Contracting Engineers for Water Gas Plant,
9, Victoria Street, London, S.W.

WILLIAM INGHAM & SONS,

Incorporated with the Leeds Fire-Clay Company, Ltd.,

WORTLEY FIRE-CLAY WORKS
Near LEEDS,

Have confidence in drawing the special attention of GAS ENGINEERS to the following advantages of their Retorts:—

1. Smooth interior, preventing adhesion of Carbon.
2. They can be made in one piece up to 10 feet long.
3. Uniformity in thickness, ensuring equal Expansion and Contraction.

PATENT
MACHINE-MADE GAS-RETORTS.

GAS AND WATER PIPES
AND
CASTINGS OF EVERY DESCRIPTION.

MANUFACTURED BY THE

CLAY CROSS COMPANY,
CHESTERFIELD.

TRADE	TELEGRAMS:	LONDON AGENTS:
CXC	"JACKSON"	BECK & Co.,
MARK.	CLAY CROSS.	130, GT. SUFFOLK ST., S.E.

GODDARD, MASSEY, & WARNER'S
IMPROVED
Sulphate of Ammonia Apparatus.

The most successful and approved Apparatus known up to the present time.

FOR REFERENCES, PARTICULARS, TESTIMONIALS, AND PRICES APPLY TO

GODDARD, MASSEY, & WARNER,
ENGINEERS,
NOTTINGHAM.

The Apparatus has been supplied to the following Firms—

BURT BOULTON, & HAYWOOD, SILVERTOWN, and ELING.
CHANCE BROTHERS, OLDBURY (FOUR APPARATUS).
RUNCORN SOAP & ALKALI CO., Limited, RUNCORN.
NETHAM CHEMICAL CO., Limited, BRISTOL.
ANIMAL CHARCOAL CO., Limited SHADWELL.
WM. BUTLER & CO., BRISTOL.
KEMPSON & CO., Pye Bridge.

And to the following Gas Companies and Corporations—

ILKESTON.	BURY.	CHORLEY.
WIDNES.	BRIGHOUSE.	WHITEHAVEN.
HALIFAX.	MARKET HARBRO'.	CHESTER.
ALTRINCHAM	PRESCOT.	SOUTH SHIELDS
DENTON.	SOWERBY BRIDGE.	LEEK.
ST. ALBANS.	LEICESTER.	IPSWICH.
DUKINFIELD.	DARWEN.	BOURNEMOUTH.
NORTHWICH.	NELSON.	SALFORD.
HUDDERSFIELD.	ORMSKIRK.	LUTON.
		HAMPTON COURT.

JONAS DRAKE & SON,

LONDON OFFICE:
60, QUEEN VICTORIA ST., E.C.

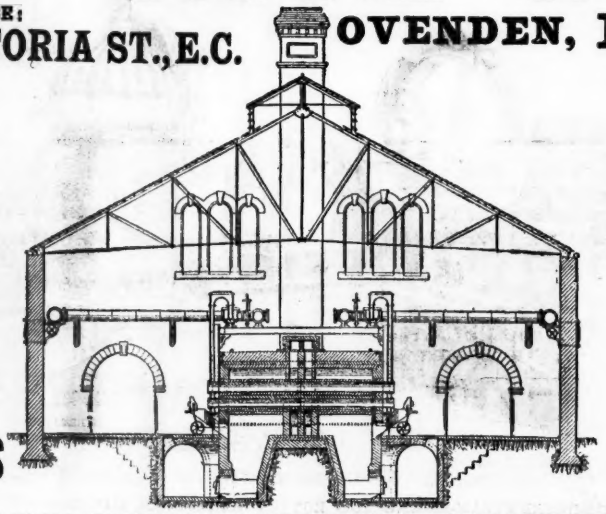
OVENDEN, HALIFAX.

TELEPHONE No. 43.
HALIFAX EXCHANGE.

TELEGRAPHIC ADDRESSES
"DRAKESON, HALIFAX."
"ECLAIRAGE, LONDON."

GAS ENGINEERS,
CONTRACTORS,
IRONFOUNDERS,

BUILDERS AND ERECTORS OF EVERY DESCRIPTION OF OVENS, BENCHES, KILNS, FURNACES, &c.



RETORT SETTERS,
FURNACE BUILDERS
ETC., ETC.

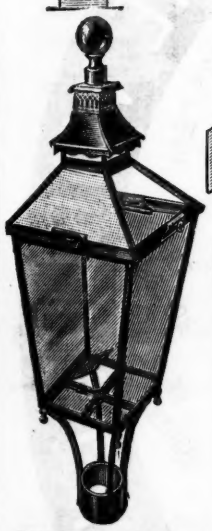
REGENERATOR AND GENERATOR FURNACES ON DRAKE'S, FRITH'S, SIEMENS'S, KLONNE'S, HASSE'S VALON'S, SOMERVILLE'S, PONSARD'S and other Principles.

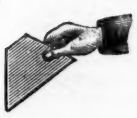
INCLINED RETORTS

RETORT SETTING IN ALL ITS PRINCIPLES AND BRANCHES. BENCHES FITTED UP COMPLETE.
DRAWINGS, SPECIFICATIONS, AND ALL OTHER PARTICULARS ON APPLICATION.

GASEOUS FIRING A SPECIALTY.

Gas Lamps and Posts.





Patent Street Lamps.

NO PUTTY.

Lamplighters' Torches.

Lever Taps.

Lamp Governors.

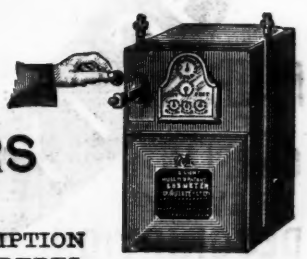
PRICE LIST ON APPLICATION.

SPECIAL HIGH-POWER LAMPS.

For Lighting Streets, Refuges, Promenades, &c., where a good light is required. Fitted with Porcelain cone, Copper top and perforation, Wrought-Iron Spray, Lever Tap, Burner and Patent Governor, glazed with Opal top.

Several thousands of these are now in use, giving general satisfaction. They are strongly made, and of best material.

GAS-METERS.



PREPAYMENT METERS

(PRICE'S PATENT)

SPECIALLY ADAPTED FOR INCREASING CONSUMPTION AMONG SMALL CONSUMERS. NO RISK OF BAD DEBTS.

D. HULETT & Co., Ltd.,

55 & 56, HIGH HOLBORN, LONDON.

HEATHCOTE GAS COAL.

RICH IN ILLUMINATING POWER AND YIELD OF GAS.
ABOVE THE AVERAGE IN WEIGHT AND QUALITY OF COKE.
MAINTAINS A HIGH STANDARD IN RESIDUALS.

THE GRASSMOOR Co., Ld., CHESTERFIELD.

CLAYTON SON & Co LTD

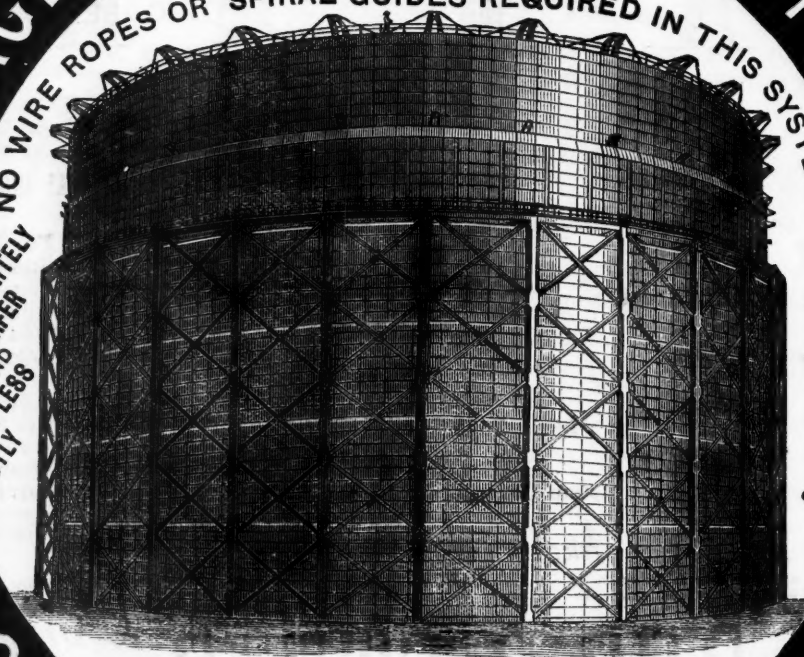
MAKERS OF

WORKS LEEDS

THE LARGEST GASHOLDER IN THE WORLD

GASHOLDERS OUR SPECIALITY

NO WIRE ROPES OR SPIRAL GUIDES REQUIRED IN THIS SYSTEM.



INFINITELY SAFER AND FAR LESS COSTLY THAN ROPES OR SPIRAL GUIDES.

CAPACITY 12 MILLION CUBIC FT.

ERECTED AT EAST GREENWICH FOR THE South Metropolitan Gas Company
IT HAS SIX LIFTS 30 FT DEEP EACH AND IS 300 FT DIAR

MAKERS OF GAS PLANT OF EVERY DESCRIPTION

ROOFS PURIFIERS &c. ALSO

ADDRESS LONDON 60, QUEEN VICTORIA ST.
TELEGRAPHIC "GAS, LEEDS."

GASHOLDERS OF ANY SIZE

ERECTED & COMPLETED WITHIN 12 MONTHS AND AT THE TIME SPECIFIED

GAS AND WATER PIPES.

Telegraphic Address: "RITCHIE MIDDLESBROUGH."

ARROL-FOULIS
Patent Automatic Machinery
FOR
DRAWING AND CHARGING GAS-RETORTS.

Full Particulars may be obtained from the Sole Makers,

SIR WILLIAM ARROL & CO., Limited,
GLASGOW.

See Illustrated Advertisement, p. II. Centre of JOURNAL for April 3.

The Climax of Regenerative Gas Lighting!!

THE
"VERTMARCHE"
A 280-CANDLE POWER PLAIN IRON LAMP,
CLASS A— 55/-
LIGHT for LIGHT
less than half the price of any other Regenerative Lamp.
Manufactured in England by
HENRY GREENE & SONS,
153 & 155, CANNON STREET, LONDON BRIDGE, E.C.
PARTICULARS AND PRICES FREE. AGENTS WANTED.

JOSEPH CLIFF & SONS,
INCORPORATED IN
THE LEEDS FIRE-CLAY COMPANY, Ltd.,
WORTLEY, LEEDS.

LONDON Offices & Depôts:
Baltic Wharf, Waterloo Bridge.
WHARVES NOS. 2 & 4, INSIDE G.N. GOODS YARD, KING'S CROSS, N.
LIVERPOOL:
16, Lightbody Street.
LEEDS:
Queen Street.

MACHINE-MADE RETORTS

Have been made in large quantities for the last twelve years; and during the whole of that time, have been in regular use at most of the largest Gas-Works in the Kingdom. They possess the excellent quality of remaining as near stationary as possible under the varying conditions of their work—a quality which will be appreciated by all Gas Engineers and Managers. The generally expressed opinion is that these Retorts are the very best that are made.

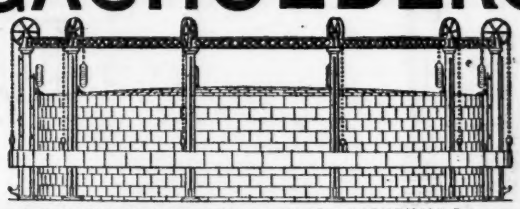
RETORTS CAREFULLY PACKED FOR EXPORT.
Fire-Bricks, Lumps, Tiles, &c., &c., of every description suitable for Gas-Works.

HARPER & MOORES,
STOURBRIDGE.
MANUFACTURERS OF
BEST FIRE-BRICKS, GAS-RETORTS,
LUMPS, TILES, AND ALL ARTICLES IN FIRE-CLAY.
Proprietors of Best Glasshouse Pot, Crucible, and other Stourbridge Clays.
MANUFACTURERS OF GLASSHOUSE POTS AND CRUCIBLES OF EVERY KIND.
ESTABLISHED 1836.

STOURBRIDGE
RETORTS AND FIRE-BRICKS.
BEST QUALITY.
KING BROTHERS, STOURBRIDGE.
[See Illustrated Advertisement, April 3, p. 597.]

OSLER,
BIRMINGHAM.
MANUFACTURERS OF GASELIERS IN GLASS AND METAL.

HENRY BALFOUR & CO.,
LEVEN, FIFE,
MAKERS OF
GASHOLDERS



PRESSURE-REGULATORS FOR GASHOLDERS (See "JOURNAL" Dec. 20, 1892.
FOUR-WAY VALVES,
AND ALL CLASSES OF GAS APPARATUS.
HENRY PUPLETT, 47, Victoria Street, S.W.

TELEGRAPHIC ADDRESS: "GAS, LEEDS."
82, QUEEN VICTORIA STREET, E.C. LONDON OFFICE.

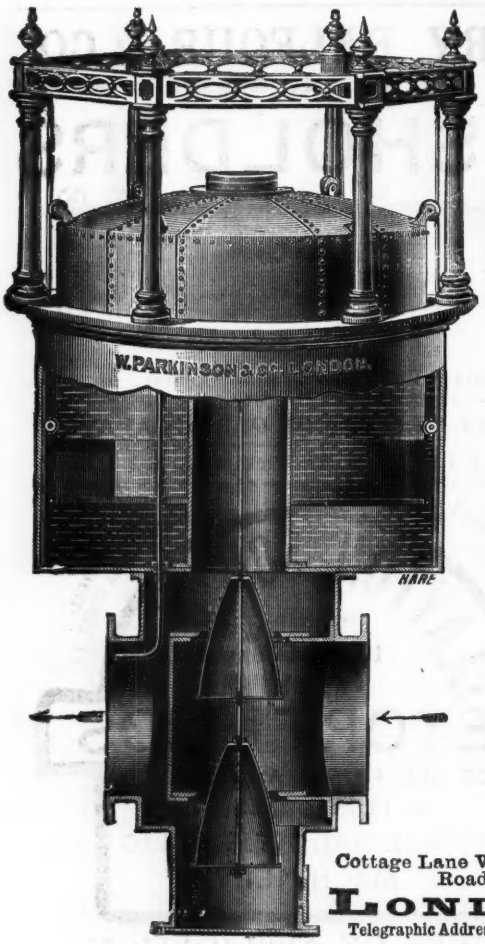
CLAYTON, SON, & CO.
LIMITED,
LEEDS,
MAKE
RETORT LIDS
OF ALL FORMS AND SHAPES
IN IRON OR STEEL
BY SPECIAL HYDRAULIC MACHINERY.

PRICES ON APPLICATION.

W. PARKINSON & CO.

SQUARE STATION METERS.

All the Meters (which number 14) at the Beckton Station of THE GASLIGHT AND COKE COMPANY have been erected by the above Firm.



PARKINSON'S PATENT EQUILIBRIUM GOVERNORS.

A very large number are now at work; and all Engineers who have adopted them speak in unqualified terms of their great efficiency.

COUNTERBALANCE or AIR VESSEL, as desired.
TWO, FOUR, or SIX COLUMNS and GIRDERS.
WEIGHTS or WATER PRESSURE.

Cottage Lane Works, City Road,
LONDON.
Telegraphic Address: "Index."

Bell Barn Road Works,
BIRMINGHAM.
Telegraphic Address: "Gas-Meters."

10, Mawson's Chambers, Deansgate,
MANCHESTER.
Telegraphic Address: "Precision."
[See also Advt. p. 690.

LONDON: Printed by WALTER KING (at the Office of King, Sell, and Railton, Ltd., 12, Gough Square); and published by him at 11, Bolt Court, Fleet Street, in the City of London.—Tuesday, April 17, 1894.